USDA FOREST SERVICE
RESEARCH PAPER NC-63
1971

Wilderness ECOLOGY

virgin plant communities of the Boundary Waters Canoe Area

LEWIS F. OHMANN ROBERT R. REAM

NORTH CENTRAL FOREST EXPERIMENT STATION
FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

CONTENTS

PAGE

Objective 1

The Study Area 4

Methods 4

Definitions 5

The Plant Communities 6

Discussion 24

Literature Cited 27

Appendix 29

Lewis F. Ohmann is a Principal Plant Ecologist for the Station at the Headquarters Laboratory in St. Paul, Minnesota. Robert R. Ream is Assistant Professor in Wildlife Management, School of Forestry, University of Montana.

North Central Forest Experiment Station
D. B. King, Director
Forest Service — U. S. Department of Agriculture
Folwell Avenue
St. Paul, Minnesota 55101

(Maintained in cooperation with the University of Minnesota)

Manuscript approved for publication March 29, 1971.

WILDERNESS ECOLOGY: VIRGIN PLANT COMMUNITIES OF THE BOUNDARY WATERS CANOE AREA

Lewis F. Ohmann and Robert R. Ream

Wilderness lands under USDA Forest Service jurisdiction are to be managed to promote, perpetuate, and where necessary, restore their wilderness character (Section 251.71 Code of Federal Regulations). But before scientific techniques are chosen to accomplish this goal for a wilderness it is important to establish a sound ecological foundation. A basic part of this foundation must be a quantitative knowledge of the structure and composition of the plant communities. This paper presents basic ecological information for the upland natural plant communities of a northeastern Minnesota wilderness area, the Boundary Waters Canoe Area (BWCA).

The BWCA (fig. 1) is unique in the National Wilderness Preservation System for the following reasons: (1) It is the only large (1,062,000 acres of land and water) Federal wilderness area in the northeastern United States. (2) It is the only lake-land wilderness. Water makes up 190,000 acres or 18 percent of the area, providing 1,200 miles of canoe routes. (3) It is divided into two major zones: a Portal Zone where the vegetation is managed for timber harvest with cognizance of primitive recreation values, and an Interior Zone where timber harvest is not permitted. The management of vegetation for commercial timber harvest in the Portal Zone necessitates emphasis of silvicultural goals and techniques. This study focuses on the Interior Zone where wilderness goals and ecological techniques are applicable.

About 40 percent of the BWCA is occupied by natural vegetation. 1/ The balance of the area has been logged, either in the "cut-out and get-out" period of the early 1900's or under controlled National Forest or State timber harvest programs of recent years (fig. 1) (Heinselman 1969). A study currently underway is focused on the vegetation now present on areas logged during the early period. If the plant communities within this logged area are found to be different from those in the virgin area, studies aimed at developing techniques for restoration of the plant communities of this logged area may be undertaken.

Heinselman (1969) has shown that fires had a very important influence on the biotic communities of the BWCA until fire control measures became effective (about 40 years ago). Such fires must have exerted their greatest influence on the drier upland communities.

In light of the above considerations it was decided that the first study of the plant communities of the BWCA should be restricted to the upland virgin (natural) vegetation of the Interior Zone.

OBJECTIVE

The vegetation of the BWCA is made up of many different plant species growing together in various mixtures at different locations. If we are to advance our knowledge of the effects of man, fire, wind, insects, disease, and time on the development and changes in this mosaic of plants, it is essential to break this mosaic down into natural units called plant communities. Plant communities may differ from one another in the species they contain, in the relative amounts of the species, or both. The objective of this study was to conduct an inventory and systematic analysis, and develop a classification of the upland virgin plant communities in this wilderness area. Thus, this paper deals primarily with the quantitative description and classification of the plant communities. Because it is intended to serve as both a description of the plant communities and as a source of quantitative ecological baseline data, it also contains an extensive appendix of data.

1/ *For the purpose of this study, virgin (natural) vegetation is defined as native species resulting primarily from environmental factors present in the ecosystem prior to settlement (and potentially still effective) or from gradual successional change. Environmental factors include windstorms, insect and disease outbreaks, and fire.*

North Central Forest Experiment Station

Superior National Forest

BOUNDARY WATERS CANOE AREA

Cut 1895 - 1940 and mostly burned after logging

National forest and state timber harvest areas 1940 - 1968

Virgin forest (never logged, but many stands are of post fire origin)

Sample stands

0 5 10 15 20 Miles

Figure 1. – Location of sample stands within the Boundary Waters Canoe Area. A few stands are outside the virgin forest area on the map, but these are also undisturbed.

1971

THE STUDY AREA

The BWCA is a part of the Superior Upland Physiographic Region. Preglacial erosion has left a rugged topography with elevation above sea level ranging from 1,119 feet at Crane Lake to 2,232 feet in the Misquah Hills. Local relief may range up to 500 feet.

This area is a part of the Laurentian Peneplain and is probably as geologically complex as any part of the world. It is underlain exclusively by Pre-Cambrian rocks. The numerous lakes lie in solid rock basins, some in granite (Saganaga Lake and Lac LaCroix), and some in ancient greenstones and slates (Knife Lake). The configuration of the bedrock determines the landform; thus long, narrow, steep ridges are typical on the slates, while low, irregular, round-topped hills prevail on the granites.

Soils of the BWCA are derived from sandy and gravelly loam glacial deposition. They are generally shallow throughout the area with rock outcrops common along ridgetops and along lake and stream shores. Glacial boulders are common within the soils.

The climate of the BWCA is typical of its midcontinent location. Winters are long and cold with a moderately heavy snowfall, and summers are warm and moist. The average annual precipitation is about 27 inches, including an average snowfall of about 59 inches. Temperatures vary between extremes of -50° F. and 100° F. The average monthly mean temperatures range from a low of about 12° F. in January to a high of 62° F. in July. The growing season is about 100 days.

METHODS

The sample design, vegetation sampling, and data summarization methods used have been described in detail (Ohmann and Ream 1971). These include random selection of stands in the sample, the use of 20 plotless sampling points for trees and saplings, 20 milacre plots for tree seedlings and tall shrubs, and 20 smaller plots for sampling other vegetative components of each stand. Data from 106 stands were summarized by computer.

General analytical procedures have been described in Ream and Ohmann (1971). Procedures pertinent to this paper include: (1) use of principal component analysis and optimal agglomeration techniques to classify the plant communities, (2) summarization of data from stands within each community type, (3) testing the statistical significance of certain species characteristics among the community types, and (4) development of an Environment Index and a Fire Disturbance Index.

Community Classification

Our philosophy in classification follows that of Whittaker (1962) in that quantitative approaches in themselves cannot solve the problems of classification. Rather, the function of community similarity measurements is to aid in making the human judgments that ultimately produce the decisions on criteria and class limits. We agree with Whittaker and many others that stands rarely fall into natural groups clearly separated from each other because of their complex compositions and varying degrees of similarity.

After testing several measures of species contribution to community structure and composition, such as basal area and percent cover, we decided that frequency of occurrence was the best measure to use in constructing the plant community classification. This confirms Orloci's (1968) conclusion that some species measurements may contain "too much information" to be useful in community classification. It also confirms a similar finding by Grigal (1968).

Frequency of occurrence values (Oosting 1956) for each species in each stand were used to calculate a similarity coefficient, which was subjected to polythetic agglomerative clustering analysis (Orloci 1967). This analysis utilizes as the agglomeration criterion the minimum increase of the within-group sum of squares resulting from the fusions of the groups. The fusion of two entities is accepted if the resultant increase in the within-group sum of squares is less than it would be by fusing either of the two with any other entity in the sample. The process is repeated in successive cycles until a hierarchy of the samples is completed (Orloci 1967). The computer program (OPTAGG) used was modified from Orloci by Dr. E. Cushing, University of Minnesota. This analysis provides stand relationships depicted two-dimensionally as a dendrogram, based on the average within-group dispersion as a percentage of the sample dispersion. However, the level of clustering best representing a useful classification can be more readily selected if the same stand relationships are viewed in more than two dimensions. The same data were, therefore, subjected to principal components analysis (Orloci 1966) using a computer program (PRINCOMP) modified from Orloci. Vector representations of species values provide a point representation of each sample stand in orthogonal space (Groenewoud 1965). The points were plotted and their three-dimensional relationships to each other were compared with the two-dimensional stand relationships of the cluster dendrogram. The dendrogram cluster level showing closest similarity to stand clustering

in orthogonal space was selected as the best community type classification.

Summarization of Community Data

Individual species data for all stands within a cluster (community type) were summarized by use of a computer program (COMSUM). Input for this program is the punched output from the four programs written for stand-data summarization (Ohmann and Ream 1971). Tables 6 through 17 in the Appendix contain the COMSUM output.

Statistical Tests of Community Data

Species that occurred in at least 50 of the 106 stands in the sample were used to determine if the communities differed from each other statistically in individual species characteristics. Since frequency of occurrence values were used to establish the classification, we used two other values for this test, basal area or percent cover, and importance value (Cottam and Curtis 1956).

Environment Index

Environmental aspects of the sampled stands were integrated into three gradients – moisture, nutrient, and heat. The importance of these gradients has been discussed in detail by Bakuzis (1959). The methods and logic in assigning measured variables to and weighting importance within each gradient generally follow those of Grigal (1968) and Grigal and Arneman (1970).

Components of the moisture gradient were: (1) Soil water retaining capacity of the B soil horizon as measured by 1/3-bar minus 15-bar soil moisture as a percent of ovendry weight; (2) soil depth over bedrock; (3) silt and clay particle size fraction of the B soil horizon; (4) total possible annual insolation (Frank and Lee 1966); (5) stand aspect (azimuth); and (6) bonus value was assigned to stands on lower slope positions and in valleys to account for water seepage.

Components of the heat gradient were: (1) Total possible annual insolation; (2) slope position; (3) distance to nearest body of water over 5 acres in size; (4) silt and clay particle size fraction of the B soil horizon; and (5) stand aspect (azimuth).

Components of the nutrient gradient were: (1) Calcium, potassium, phosphorus, and pH values of the B soil horizon; and (2) bonus value was assigned to stands on lower slope positions and valleys to account for possible flushing of nutrients.

The values for each stand were averaged within each community to provide a gradient value for each of the communities. The three gradient values were then averaged to provide the Environment Index. The Index has a possible range from 1 to 5. Lower values indicate drier, warmer, and lower nutrient conditions. Higher values indicate moister, cooler, and higher nutrient conditions.

Fire Disturbance Index

Fire has been shown to be an important environmental factor influencing the vegetation of the area (Heinselman 1969). We recognize that time is fundamentally different from other factors that specify a system (Ashby 1960). An index of the time elapsed since the last major fire disturbance in each of the sampled stands was established from tree ages, and each stand was rated on a scale from 1 to 5 (1 for the most recent to 5 for the most ancient fires). The values for each stand were averaged for each community to form the Fire Disturbance Index. Low values indicate recent disturbance, and high values indicate less recent disturbance and thus more time for succession to be expressed.

DEFINITIONS

Basal area. – Square feet of tree cross section (at d.b.h.) per acre (BA).

Browse Index. – An estimate of the influence of browsing by wildlife on woody twigs of tall shrubs. Measured in four categories for each species as follows: 0 = not browsed, 1 = 0 to 1/3 browsed, 2 = 1/3 to 2/3 browsed, 3 = more than 2/3 browsed. Index is the average for species in a community type.

Commonness Index. – A measure of the commonness of a species in all the stands of a community type. It is directly related to the chance of finding a particular species at a given point within a stand of a community type .(Curtis 1959). This Index may range from 0 to 10,000 for a species and is obtained by multiplying the average frequency-of-occurrence in sample points or plots within a community type by the percent of stands within a community type in which the species was present. This has also been called the Frequency x Presence Index (Curtis 1959).

Community Type. – A group of stands that are more similar to each other than to other stands as determined by the use of objective analytical procedures. The term has been reduced to "community" in the text but it should be recognized that the description is for the abstract community type (group of stands) rather than a concrete example of the community type (stand). Each stand within the type is similar to the description for the

type (within variation described in the text). Names that have been assigned to these community types reflect an important feature of the type, usually the most important tree species.

Density. – Number of stems per acre.

Dominant. – The most important species in a community type in terms of number of individuals per acre, basal area per acre, percent cover, or frequency of occurrence.

Herb. – Flowering vascular plants, ferns, club mosses, and horsetails of a herbaceous nature.

Importance value. – A summation of relative values of density, basal area (or cover), and frequency for species within a community type. This provides a means of comparing each species contribution to the composition of the type.

Index of Distinctness. – A measure of the degree to which a community type is visibly distinct from related community types as indicated by the number of prevalent species which attain their highest measured values in that community type, expressed as a percentage of the total number of prevalent species in that community type (Curtis 1959).

Index of Diversity. – A measure of the floristic richness of a community type, calculated by dividing the difference between the total number of species in all of the stands of a community type and the average number of species per stand by the Napierian logarithm of the number of stands within the community type (Curtis 1959).

Index of Homogeneity. – A measure of similarity among stands within a community type, expressed as a ratio of the sum of presence values of the prevalent species to the sum of presence values of all species in the community type (Curtis 1959). The Index ranges from 0.00 for no similarity to 1.00 for totally alike floras.

Low shrub. – Shrub species of less importance to wildlife browse production. They were sampled in the 1- by 2-foot plots along with the herbs, mosses, etc.

Modal species. – A species that has its maximum presence value in a given community type (Curtis 1959).

Mosses and lichens. – Layer of vegetation nearest the ground composed of feather mosses, other mosses, reindeer moss (lichens), and other lichens.

Number of species. – Tree, sapling, and seedling size classes are treated as separate species thus inflating the number of species recorded in a community type. Certain other species are lumped by groups, such as grasses, and sedges, thus deflating the species number totals.

Presence. – A term indicating the degree to which a species occurs in the stands that make up a community type, expressed as a percentage of the total number of stands within the community type (Curtis 1959).

Prevalent species. – The topmost species counted off to a number equal to the average number of species found in all stands within a community type when all species are arranged in decreasing order of their presence percentages (Curtis 1959).

SAF cover type. – A classification scheme presented by the Society of American Foresters (1954) that describes commercially important forest types.

Sapling. – Tree species between 0.96 and 3.95 inches in diameter at breast height (d.b.h.).

Seedling. – Tree species less than 0.96 inch in d.b.h., which may be of seed or sucker origin.

Stand. – An area of virgin vegetation more or less uniform in physiognomy, composition, and habitat conditions.

Tall shrub. – The vegetation layer important in the production of woody winter feed (browse) for wildlife. To facilitate sampling, shrub species were placed into two arbitrary categories before fieldwork began, tall and low shrubs. Tall shrubs were sampled in milacre plots.

Tree. – Woody species over 3.96 inches in d.b.h.

THE PLANT COMMUNITIES

The 106 stands in the sample were classified into 12 plant community types (table 1). Only one of the 12 types, the lichen community type, is nonforest. It is restricted to rock outcrops on ridgetops and upper slopes. It is characterized by the importance of lichens and mosses and by the lack of many woody plants. This type comprises slightly less than 4 percent of the stands in the sample (fig 2).

Another four community types are alike in one respect – the importance of jack pine (scientific names appear in Appendix table 5) in the canopy. Over one-third of the stands in the sample are in this group (fig. 2). In two of these communities, jack pine (oak) and jack pine (fir), jack pine is the dominant of the canopy. Major differences between these communities are the physical setting, the tree reproduction present, and the species of low shrubs present. In the other two communities, jack pine-black spruce and black spruce-jack pine, jack pine shares canopy dominance with black spruce. The major difference between these communities is the totally different aspect of the understory. In contrast to the jack pine-black spruce community, the black spruce-jack pine community has virtually no shrub and herb layer, but has a well developed moss layer that covers the ground and the numerous boulders which would otherwise be bare.

Table 1. – Index values for moisture, heat, and nutrient gradients, their average (the Environment Index), and the Fire Disturbance Index range from 1 to 5. The lower numbers represent drier, warmer, and poorer sites, and more recent fire disturbance.

Item	Community											
	Lichen	Jack pine (fir)	Jack pine (oak)	Black spruce-jack pine	White pine	Jack pine-black spruce	Maple-aspen-birch	Aspen-birch	Red pine	Budworm-damage	Fir-birch	White-cedar
Moisture gradient	2.6	3.6	3.3	3.1	3.1	2.8	2.9	2.9	2.8	3.4	3.2	3.1
Heat gradient	2.4	3.2	3.1	3.1	3.1	2.9	3.4	3.1	3.5	3.3	3.8	3.8
Nutrient gradient	--	2.8	2.7	2.9	2.7	1.9	2.8	3.1	2.2	3.1	3.1	3.2
Environment Index	2.5	3.2	3.0	3.0	3.0	2.6	3.0	3.0	2.8	3.3	3.4	3.4
Fire Disturbance Index	2.0	2.1	2.4	2.4	2.8	2.9	3.1	3.2	3.5	3.5	4.4	4.6

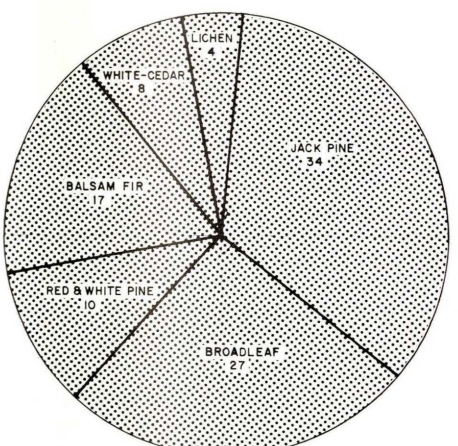


Figure 2. – Distribution (in percent) of sample stands among community-type groups.

The jack pine (oak) community is most similar to SAF cover type 1, the jack pine (fir) and jack pine-black spruce communities to SAF type 6, and the black spruce-jack pine community to SAF types 6 or 12.

Evidence points to a future decrease of the jack pine component with a corresponding increase in the more tolerant black spruce and balsam fir, with some white spruce, paper birch, white-cedar, and mountain-ash as minor associates. A shift to more mountain-ash as an understory (subcanopy) tree, an increase in mountain maple and fly honeysuckle in the tall shrub layer, an increase in creeping snowberry, bishop's-cap, goldthread, bedstraw, and club-mosses in the herb layer, and perhaps a generally greater predominance of mosses over herbs will likely occur.

Two of the community types are dominated by broadleaf trees. These are the maple-aspen-birch and the aspen-birch community types. The two differ principally in the importance of red maple as a tree, sapling, and seedling. Together they comprise more than 25 percent of the stands in the sample (fig. 2). The outstanding features of these two communities are the importance of broadleaf trees, and the luxuriant growth of the tall shrub and herb layers. This group is of much importance to wildlife species that currently inhabit the area. Browse indices for many of the shrub species are high. In addition to providing deer (*Odocoileus virginianus* Boddart.) and moose (*Alces alces* L.) browse, these two communities may be important to ruffed grouse (*Bonasa umbellus* L.) and beaver (*Castor canadensis* Kuhl.).

Two of the types described are those most often associated with the virgin forest in the mind of the visitor to the wilderness area. They are the red and the white pine community types. Actually these two communities make up a rather small part of the stands in the sample, about 10 percent (fig. 2).

One of the features of the two pines so important in these communities is their longevity. Also, mature red pines in particular and white pines to a lesser degree are fire resistant. In nature, fires often burn through these

communities removing any understory present. This produces an excellent seedbed, which, if a seed crop is present, may result in a new generation of understory pines. When this occurs at about the time the pine overstory has started to open due to age or some other factor, the community type can maintain itself. At present most of the red and white pine stands that were sampled are not yet at the point where the tree canopy is opening; and because of fire protection they have an understory which is not pine but balsam fir or spruce. With continued protection from fire, spruce and fir will eventually replace the pine.

Two community types, the budworm-disturbed and the fir-birch, are characterized by the presence of balsam fir. It is important as a tree, sapling, and seedling. It should not be inferred that all stands in the budworm-disturbed type have been damaged by the spruce budworm (*Choristoneura fumiferana* Clem.). In fact, there is budworm damage to stands in both communities, but to a lesser extent in the fir-birch community. Seven of the 10 budworm community stands were damaged and five of the eight fir-birch community stands showed some damage. Another difference between the two communities that may contribute to a greater abundance of fir in the fir-birch community is the longer period since the last major fire disturbance in the fir-birch stands.

Seventeen percent of the stands in the sample (fig. 2) fell into these two community types. They appear to be ecologically capable of increasing with continued protection from fire.

The final plant community is dominated by northern white-cedar. The white-cedar community type comprises about 8 percent of the stands in the sample (fig. 2). Most of these stands were located at relatively high elevations on north-facing slopes of the east-west trending ridges of the Rove Slate Geological Formation in the eastern portion of the BWCA, Mountain-ash, mountain maple, and ground-hemlock are characteristic species of this community type.

Lichen

The lichen community is the only nonforested community type recognized from data collected in this study. It is restricted to rock outcrops on ridgetops and upper slopes (fig. 3). It has the lowest ranking of all the communities on the Environment Index, indicating the xeric nature of the habitat on which it occurs (table 1).

The community contains the fewest species (32) and the lowest average number of species in any one stand

Figure 3. – A lichen community on the rock outcrop in the foreground with a jack pine (oak) community in the background.

(11.5). The flora is depauperate (Index of Diversity of 11.4) but consistent among stands (Index of Homogeneity 0.99). It is the most distinct community type, as might be expected due to its nonforest nature (Index of Distinctness 50.0) (table 2). The depauperate flora may be misleading because two important floral components of this community were treated as groups rather than individuals. Lichens other than the reindeer mosses, and mosses other than the feather mosses, Dicranum, and the hairycap moss were treated as groups; together they account for 40 percent of the ground cover within the community. About 30 percent of the surface in this community is bare rock. The reindeer mosses (actually lichens) and the hairycap moss are also important in this essentially two-layered community. The more scattered second layer contains a few shrub species such as bush honeysuckle, which averages 8,000 stems per acre. Juneberry, mountain maple, and willow are also present. Tree seedlings are also found in this layer, with jack pine, red maple, red oak, quaking aspen, mountain-ash, and paper birch represented. Three herbs, pink corydalis, bristly sarsaparilla, and white cinquefoil, are the species most unique to this community.

Sophisticated objective methods are not required to separate this community type from the others, but the type serves as a good check on the methods used. If the stands in this type did not separate out as a unique group, one could not have much confidence in the methods used for defining community types. In our analysis, the stands constituting this community grouped closely and were well separated from the other groups.

Table 2. – Comparison of the virgin plant communities

Community	Number of stands	Percent total stands	Number of species	Families in species	Number of modal species	Index of Diversity	Index of Homogeneity	Index of Distinctness
Lichen	6	5.7	32	19	9	11.4	0.99	50.0
Jack pine (oak)	11	10.4	81	25	12	17.7	.46	17.9
Jack pine (fir)	7	6.6	95	30	15	24.7	.55	8.9
Jack pine-black spruce	7	6.6	83	26	5	20.5	.50	7.3
Black spruce-jack pine	10	9.4	75	23	6	20.7	.82	16.0
Aspen-birch	13	12.3	112	30	27	25.7	.59	25.6
Maple-aspen-birch	15	14.2	104	34	18	21.8	.49	15.9
White pine	6	5.7	80	23	8	21.2	.53	10.0
Red pine	4	3.8	67	25	16	20.4	.56	24.3
Budworm	10	9.4	102	31	11	23.8	.53	11.1
Fir-birch	8	7.5	86	30	13	20.2	.49	19.5
White-cedar	9	8.5	85	28	25	20.8	.56	35.1

The lichen community may be viewed as an early stage of succession after some major disturbance, such as fire, or as primary succession on rock outcrop bared through glaciation (Oosting 1956). No doubt most of these communities have been disturbed more than once since glacial time by wildfire, which removed the accumulated organic material. Any mineral soil that may have accumulated through glacial deposition, weathering of the rock, or movement by air or water would then be subject to erosion. Wildfires may have been frequent enough to prevent this community from progressing toward a woody community type.

With continued lack of disturbance, principally through protection from wildfire, this community type will have more shrubs and small trees. Over a long time it could accumulate more soil and become a woody-plant community rather than a lichen-dominated community.

Jack Pine (Oak)

One of the most characteristic features of this community is its physiographic setting – bald rock ridges and rock outcrops (fig. 3). Bare rock is almost always present, and the type is often interspersed with smaller areas of lichen community.

This community occupies a middle position in the Environment Index. It drops well into the lower half of the Fire Disturbance Index, when period since fire is considered (table 1). This reflects the fact that the stands are not extremely old, but have mostly originated after major fires in 1864, 1894, and 1910. All of these fires occurred under especially droughty conditions and burned extensive areas (Heinselman 1969).

Although stands of this type are usually situated on ridgetops or upper slopes, they do occur down to midslope. Slopes on which the stands are found average about 10 percent, with as little as 3 percent on ridgetops to as much as 24 percent at midslope.

Although jack pine grows best on well-drained loamy sands, it can adapt to very dry sandy or gravelly soils where other species can scarcely survive, and it will also grow over rock outcrops and bald rock ridges (USDA Forest Service 1965). Soils in this community type are characteristically very shallow, generally less than 20 inches above bedrock and as little as 6 inches above bedrock in some stands. Most of the sampled stands were on granite bedrock. This may, in part, reflect the response of this resistant substrate to glaciation. The higher elevations were probably scraped to bedrock by glaciation, and much of what was later deposited during glacial recession eroded, resulting in shallow soils overlying the slow-weathering granite of these ridges.

This community shows the lowest floral richness of the forested communities (Index Diversity 17.7), and a high variability in species occurrence among stands, as indicated by the low Index of Homogeneity (0.46) (table 2). Eighty-one species of plants (representing 25 families) are found in this community. None of these families are unique to the community. The families Cupressaceae, Fagaceae, and Orchidaceae, though represented in this community, did not occur in the samples from the jack pine (fir) community stands.

Prevalent modal species in this community are jack pine (trees and saplings); red oak (saplings and seedlings); Bebb willow (tall shrub); and late sweet blueberry and wintergreen (low shrubs) (table 3).

Jack pine is *the* dominant tree of the community with an average density of 315 trees per acre and 82 square feet of basal area per acre (BA). This would classify the site as very poor to poor for 60-year-old jack

Table 3. – The prevalent modal species within each community. The number below each listing is the additional species within the community that are modal but not prevalent. T, SA, and SE represent tree, sapling, and seedling size classes of tree species, respectively

Lichen	Jack pine (oak)	Jack pine (fir)	Jack pine-black spruce
Pink corydalis	Jack pine (T)	White spruce (SA)	Black spruce (T)
Hairy-cap moss	Jack pine (SA)	Goldthread	Black spruce (SE)
Cladonia mitis	Red oak (SA)	Twin-flower	Bunchberry
Cladonia rangiferina	Red oak (SE)	Running clubmoss	
All other lichens	Bebb willow		
Spotted peltigera	Late sweet blueberry		
	Wintergreen		
3	5	11	2
Black spruce-jack pine	**Aspen-birch**	**Maple-aspen-birch**	**White pine**
Black spruce (SA)	Quaking aspen (T)	Red maple (T)	White pine (T)
Dicranum	Quaking aspen (SA)	Red maple (SA)	Bush honeysuckle
Plume moss	Quaking aspen (SE)	Red maple (SE)	Wild sarsaparilla
Schreber's moss	Paper birch (SA)	Common twisted-stalk	Wood anemone
	Beaked hazel	False lily-of-the-valley	
	Green alder	Star-flower	
	Round-leaved dogwood	Ground pine	
	Clinton's lily		
	Large-leaf northern aster		
	Upland strawberry		
	Bracken fern		
2	16	11	4
Red pine	**Budworm-damaged**	**Fir-birch**	**White-cedar**
Red oak (T)	White spruce (T)	Balsam fir (T)	White-cedar (T)
Red pine (T)	Dewberry	Balsam fir (SA)	White-cedar (SA)
Red pine (SA)	Red raspberry	Paper birch (T)	White-cedar (SE)
White pine (SA)	Fringed bindweed	Paper birch (SE)	Balsam fir (SE)
White pine (SE)	One-sided pyrola	Mountain maple	Mountain-ash (SE)
Juneberry		Sweet bedstraw	White spruce (SE)
Sweet fern		Stiff clubmoss	Fly honeysuckle
Velvet-leaf blueberry		All Other mosses	Ground-hemlock
Cow-wheat			Thimbleberry
			Bishop's cap
			Violet
			Oak fern
			Hylocomium
7	6	5	12

pine (USDA Forest Service 1965). The next most important tree species is black spruce, with only 26 trees and less than 5 BA.

Jack pine is also important in the sapling class with a density of 69 stems and 4 BA. Black spruce saplings are almost as important, with 55 stems and 2 BA. Paper birch is less important in density and basal area than jack pine and black spruce, but it has a higher Index of Commonness because it is more widespread. Many of the jack pine in the sapling class are actually the same age as larger jack pine trees due to suppression and thus are not transgressive individuals important in succession.

The most important seedlings are red maple, red oak, and black spruce, with average densities of 9,000, 300, and 250 stems respectively. Red maple is a prolific seed producer, thus small red maple seedlings are numerous; most will not live through the first few growing seasons, however.

Bush honeysuckle is the most important tall shrub with an average density of almost 5,000 stems. Juneberry shows only 1,500 stems but has a Browse Index of 1.2, compared with 0.4 for bush honeysuckle; thus it is more important to wildlife. Beaked hazel is another important tall shrub, with a density of over 2,000 stems and a Browse Index intermediate between juneberry and bush honeysuckle (table 4).

Late sweet blueberry is an important member of the low shrub class. It, along with wintergreen, velvet-leaf

Table 4. – Density per acre (D), basal area per acre (BA), importance value (IV), and Browse Index (BI) for seven important tall shrubs in the 12 communities

Community	Willow				Juneberry				Bush honeysuckle				Green alder			
	D	BA	IV	BI	D	BA	IV	BI	D	BA	IV	BI	D	BA	IV	BI
Lichen	409	0.1	12	1.50	100	0.1	4	1.85	8,375	1.8	29	0.90	0	0.0	0	0.00
Jack pine (oak)	328	.4	9	1.15	1,509	.4	15	1.17	4,796	1.0	39	.45	923	.6	10	.77
Jack pine (fir)	35	.1	1	2.00	479	.2	4	.92	6,014	1.3	36	.67	1,279	1.0	10	.60
Jack pine-black spruce	21	.1	1	1.30	707	.2	19	1.26	2,571	.5	39	.77	279	.2	8	.65
Black spruce-jack pine	5	.1	1	2.00	40	.1	4	1.75	840	.2	40	.73	60	.1	8	.00
Aspen-birch	386	.5	2	2.18	1,117	.8	4	1.34	21,309	4.5	27	.87	5,785	3.9	11	.83
Maple-aspen-birch	40	.3	1	.70	683	.4	6	.87	1,207	.3	8	.54	580	.5	4	.45
White pine	25	.1	1	2.00	892	.4	12	1.45	12,525	2.6	49	.97	442	.3	3	.60
Red pine	100	.1	2	3.00	1,700	.4	23	2.48	225	.1	5	.67	750	.4	14	2.00
Budworm-damaged	20	.1	1	1.83	215	.1	5	.77	2,025	.4	19	.61	435	.4	3	1.00
Fir-birch	0	.0	0	.00	88	.1	2	1.58	338	.1	4	.51	25	.1	1	1.50
White-cedar	6	.1	1	1.00	44	.1	1	1.17	317	.1	5	.72	56	.1	1	.00

Community	Beaked hazel				Fly honeysuckle				Mountain maple			
	D	BA	IV	BI	D	BA	IV	BI	D	BA	IV	BI
Lichen	0	0.0	0	0.00	0	0.0	0	0.00	8	0.1	1	0.00
Jack pine (oak)	2,296	.8	15	.76	50	.1	1	.33	159	.1	2	1.00
Jack pine (fir)	5,500	2.8	27	1.04	564	.1	5	.78	2,100	1.3	14	.82
Jack pine-black spruce	1,479	.8	22	.63	93	.1	2	.25	164	.1	2	1.50
Black spruce-jack pine	25	.1	3	1.00	90	.1	7	1.75	0	.0	0	.00
Aspen-birch	13,383	7.4	32	1.08	609	.1	2	1.50	4,856	3.3	14	1.85
Maple-aspen-birch	7,613	3.9	42	.68	293	.1	2	1.50	3,767	2.3	30	.95
White pine	3,068	1.3	20	.87	375	.1	3	.60	1,583	1.8	16	.55
Red pine	1,438	.5	27	1.13	0	.0	0	.00	0	.0	0	.00
Budworm-damaged	3,355	1.6	28	.69	790	.2	14	.92	1,425	.9	25	1.46
Fir-birch	1,396	.8	15	.73	744	.2	8	.72	6,690	4.2	68	1.45
White-cedar	950	.6	12	.75	661	.1	13	.81	5,661	4.3	53	1.66

blueberry, and sweet-fern (a tall shrub), are all indicators of relatively open, dry conditions.

The most important herbs and mosses are false lily-of-the-valley, large-leaf northern aster, Dicranum moss and Schreber's feather moss, and reindeer moss (lichens).

Jack pine occurs primarily in a pioneer stage of succession after mineral soil has been bared. In nature most stands originate following fire. The stands in this community range from 60 to 105 years old, reflecting the years since the last major fire. In the absence of disturbance, jack pine tends to give way to more tolerant species. In parts of Minnesota, on loamy sands or sandy loams, succession moves toward red pine and eastern white pine and then to northern hardwoods. Sometimes the red and white pine stages are absent and the trend is toward shrubs like alder and hazel, and then to aspen and paper birch followed by either northern hardwoods or spruce-fir (USDA Forest Service 1965). In the northern part of the Great Lakes-St. Lawrence Region (as defined by Rowe (1959)) jack pine is replaced by black spruce, white spruce, and balsam fir or by red and white pine, which are followed in turn by a spruce-balsam mixture (Cayford *et al.* 1967). In northeastern Minnesota and Canada, jack pine is thought to be succeeded by black spruce, white spruce, balsam fir, and paper birch (LeBarron 1948). Sapling and seedling data from this community within the BWCA generally support LeBarron's interpretation of jack pine succession for northeastern Minnesota. However, significant amounts of red maple and red oak reproduction and smaller amounts of red and white pine reproduction are present. Thus, while we believe this community is following the general pattern of succession to spruce and fir proposed for northeastern Minnesota and Canada, it also shows a tendency toward hardwood or red and white pine stages which have been proposed for other portions of this region.

The data suggest that this type will decrease with continued protection from disturbance. The process may be much slower in this community than in others where

Figure 4. – Dense balsam fir reproduction in a jack pine (fir) community.

jack pine is an important constituent because of the poor site quality.

Jack Pine (Fir)

This community is similar to the jack pine (oak) community in two respects: (1) Both are totally dominated by jack pine (trees), and (2) both show a relatively short period since last major fire.

The jack pine (fir) community (fig. 4) ranks high on the Environment Index. It has the highest value on the moisture gradient but is much lower on the nutrient gradient. The short period since disturbance is indicated by a low ranking on the Fire Disturbance Index (table 1).

It differs from the jack pine (oak) community in four major respects: (1) Soils are much deeper, mostly more than 20 inches, and often more than 40 inches above bedrock; (2) bedrock outcrop is not generally found in the stands, although the ground surface may contain numerous large boulders; (3) it is more consistently found on mid- to lower slopes, as well as occasionally on upper slopes and ridgetops; and (4) it is more often located on north to northeast facing slopes.

Not only are the soils deep, but they tend to be high in silt and clay content. This is also true for the soils of the jack pine (oak) community. The silt-plus-clay fraction in the B soil horizon is higher for these two communities than any of the others. This has also been noted for another study area of the BWCA. 2/ We believe the presence of jack pine communities on soils with higher silt-clay content reflects the influence of a history of fire disturbance rather than restriction of jack pine to certain sites through interspecific competition.

The total number of species found in the community is 95, with an average of 46 per stand. Thirty families are represented, none of which are unique to the community. Three families, the Equisetaceae, Osmundaceae, and Polygonaceae, are found here but not in any of the other jack pine communities. Only the aspen-birch community shows a higher Index of Diversity than this community. The flora is highly variable from stand to stand within the type, as indicated by the Index of Homogeneity of 0.55 (table 2).

Prevalent modal species are white spruce saplings, twinflower, goldthread, and running club-moss. In addition to these there are 11 other modal species that are not prevalent (table 3).

2/ *Ohmann, L. F. A study of two recent wildfire areas in the Boundary Waters Canoe Area. 1969. (Unpublished study plan on file at North Central Forest Exp. Sta., USDA Forest Serv., St. Paul, Minn.)*

As in the jack pine (oak) community, jack pine is *the* dominant of the canopy with an average density of 303 stems and a BA of 90. Balsam fir with 40 trees and 7 BA and black spruce with 57 stems and 10 BA are of lesser importance. Other trees are quaking aspen, paper birch, white spruce, and even fewer bigtooth aspen, balsam poplar, and red maple.

The dominant saplings are balsam fir and black spruce, which combined account for 250 stems and 10 BA. Balsam fir is more evenly spread through the stands of the community but black spruce is present in greater numbers and has a slightly greater basal area. Paper birch is also important in the sapling class. As in the jack pine (oak) community, the few jack pine saplings present are the same age as the overstory trees and are not really transgressive. Other saplings present include quaking aspen, white spruce (which has its greatest value as a sapling in this community (fig. 12 in Appendix)), bigtooth aspen, and red maple.

The most important tree seedling is balsam fir, with 1,400 stems and 2 percent ground cover. Red maple, quaking aspen, and paper birch seedlings are fewer with 500, 300, and 220 stems, respectively. Black spruce seedlings are uncommon, with an average of 135 stems, and are not found in every stand within the community.

The tall shrub layer is much better developed here than in the jack pine (oak) community and is dominated by bush honeysuckle and beaked hazel, with an average of 6,000 and 5,500 stems each. Mountain maple is also important, with over 2,000 stems per acre. Other tall shrubs, in order of decreasing importance, are green alder, fly honeysuckle, juneberry, and willow. Of these, willow, beaked hazel, juneberry, and mountain maple show the heaviest browsing by wildlife (table 4).

The low shrub class is not well developed; the most important species is late sweet blueberry, which has an average ground cover of about 1 percent (compared with almost 7 percent in the jack pine (oak) community (table 7 in Appendix)). Dewberry is the second most important, with velvet-leaf blueberry, wintergreen, prickly rose, pipsissewa, and creeping snowberry (which reaches its maximum importance here (fig. 15 in Appendix)) all of lesser importance.

The herb layer is well developed. The five most common flowering herbs have a combined ground cover of 25 percent. The most important of these is large-leaf northern aster; others are false lily-of-the-valley, bunchberry, twinflower, and Clinton's lily.

As is generally the case when the herb layer is well developed, mosses and lichens are scarce.

The five most common mosses and lichens have a combined ground cover of 19 percent. The most important are Schreber's feather moss and Dicranum moss.

The community is rather young in terms of succession, and will apparently give way to more tolerant balsam fir, and white and black spruces.

Jack Pine-Black Spruce

This is the third of the four communities in which jack pine is a major canopy constituent. In many ways the community is much like the two previously described; however, in those jack pine is clearly dominant, while here it is only codominant with black spruce.

On the Environment Index it is the lowest ranking of the jack pine group (table 1). It is lower for the following reasons: (1) low water retention capacity of the B soil horizon; (2) location of stands on southerly and southwesterly facing slopes; (3) location of stands farther from water bodies; and (4) low levels of calcium, potassium, phosphorous (and low pH) in the B soil horizon. This community ranks highest of the jack pine group in the Fire Disturbance Index (table 1). Most of the stands originated in 1864, a few in 1894, and one as late as 1918. The stands are slightly older than those in other jack pine community types.

Stands were found on upper and lower slopes, but not in valleys or on ridgetops. Slope of the terrain within stands averaged 8 percent, with a range from 3 to 13 percent. Soil depths are consistently between 24 and 36 inches over bedrock; bedrock outcropping is uncommon, but large boulders at the soil surface and in the upper soil horizons are conspicuously present.

Eighty-three species representing 26 families were encountered, with an average of 42 species per stand. None of the families are unique to the type.

Only five plants are modal and three of these are prevalent (table 3). The latter are black spruce trees and seedlings, and bunchberry. The two nonprevalent modal plants are the flat-stemmed ground-pine (a club-moss) and bigtooth aspen seedlings. The Index of Diversity is 20.5 and the Index of Homogeneity 0.50 for this community (table 2).

The most numerous tree is black spruce with 160 stems, compared with 127 stems for jack pine. However, jack pine has 54 BA, while black spruce has only 32.

This means that the jack pine are larger but that there are fewer of them. Other trees of much less importance are quaking aspen, paper birch, white pine, red pine, balsam fir, white spruce, and red maple.

The sapling class is dominated by black spruce with 186 stems and 6 BA. Paper birch is a distant second with 25 stems and less than 1 BA. Also present in this class are balsam fir, red maple, quaking aspen, and a few other species.

Red maple is the most numerous seedling (4,000 stems),but it is probably not as important in terms of successional processes as black spruce. Although the black spruce seedlings number only 550 per acre, they provide a ground cover almost equal to the 4,000 red maple seedlings. Also present are quaking aspen, paper birch, balsam fir, and white pine seedlings.

Tall shrubs are less abundant here than in either the jack pine (oak) or jack pine (fir) communities. Bush honeysuckle is the most common with 2,500 stems, but has a low Browse Index (table 4). Beaked hazel is second with 1,500 stems, but also a low Browse Index. Juneberry is only the third most important shrub in stems per acre, but it has a relatively high average Browse Index (table 4). Other shrubs are green alder, fly honeysuckle, and mountain maple.

The low shrub class is dominated by the late sweet blueberry. Of lesser importance are wintergreen, velvetleaf blueberry, raspberry, prickly rose, and other species.

The herb and moss-lichen components are about equally well represented. Bunchberry is the most important herb and Schreber's feather moss is the most important moss. False lily-of-the-valley, large-leaf northern aster, Clinton's lily, and bracken fern are other important herbs. Dicranum moss is also important.

The two best indicators of this community are the black spruce dominance of the sapling class and bunchberry dominance of the herbs.

While jack pine is important in this community, black spruce is more consistently present in all stands. One stand in this type does not have jack pine in it at all. In another stand red pine is more important than jack pine, while in others white pine is more important. The type could as well have been called the mixed pine-black spruce community.

The fact that jack pine tends to dominate the tree class may be due to the initial composition of the stand after the last fire and more rapid growth of the jack pine. This resulted in black spruce being suppressed, and consequently many of the black spruce stems now fall into the sapling class instead of the tree class.

In some stands the jack pine trees present were dying. Thirty more jack pines would have been included in the sample of 560 trees had they been alive.

As noted above, many of the black spruce saplings in this community are actually the same age as the black spruce trees. Paper birch, balsam fir, and red maple are probably the species in this community that are important in succession. The presence of black spruce seedlings, however, indicates the ability of black spruce to maintain itself. Another feature of young black spruce that may be of some importance in succession is their capability of layering (vegetative reproduction).

Jack pine will become less important in this community in the near future. Red pine and white pine will continue to be present in the community for a longer time, due to their greater longevity. Black spruce will probably become more important in the tree class and somewhat less important in the sapling class, as more balsam fir, paper birch, and other tolerant species become more important. Concurrent changes in the understory plants will also occur; more mountain maple and fly honeysuckle will become established; and moss cover will increase over herb cover.

Black Spruce-Jack Pine

This community is not very similar to the others of the jack pine group (fig. 5). It is characterized by very poor development of shrub and herb components and an extremely well developed moss layer, which produces a carpet-like appearance on the ground. Surface boulders are common but are mostly covered by the luxuriant growth of mosses, and thus appear more like mounds rather than boulders.

The community is in the middle of the Environment Index and its position is influenced by period since disturbance, as indicated by its lower ranking in the Fire Disturbance Index (table 1).

Stands are most often located on southerly and westerly facing slopes, and on mid- to lower slopes (although some occur on upper slopes and ridgetops). Slopes averaged 9 percent and ranged from 5 to 25 percent.

Soil depths are mostly in the range of 18 to 24 inches above bedrock. They are deeper than the soils of

Figure 5. – The sparse understory and moss-covered forest floor of a black spruce-jack pine community.

the jack pine (oak) community but generally shallower than those of the jack pine (fir) community. Bedrock outcrops in the stands are limited, but boulders on the surface and in the upper part of the soil profile are a major feature.

Many stands in this community originated from fires in 1864, 1894, and 1903. Some stands that did not fall within the sample followed a 1910 fire.

The lack of a well developed shrub and herb layer probably accounts for the relatively low number of species encountered in this community – a total of 75 in the type and an average of 26 per stand. Twenty-three families are represented in the flora, none of which are unique to this community. The Index of Homogeneity is the highest of all of the forested communities (0.82), indicating that the stands in this type are similar to each other floristically (table 2).

The four prevalent modal species are black spruce (saplings), Schreber's and plume feather mosses, and Dicranum moss (table 3). This is another indication of the luxuriant moss growth. Two other species are modal in this community but are not prevalent – Labrador tea (a shrub), and creeping lattice-leaf (an orchid).

Two species dominate the tree class: black spruce, which is very common (409 stems) but of relatively small diameter (67 BA), and jack pine, which is less common (315 stems) but of larger diameter (78 BA). Of much less importance are scattered balsam fir, paper birch, quaking aspen, white spruce, and an occasional northern white-cedar.

The sapling class is dominated by black spruce, with 444 stems and 18 BA. Many of these are suppressed. Less common saplings are paper birch, balsam fir, a few suppressed jack pine, and scattered stems of white spruce and white-cedar.

Balsam fir seedlings are most abundant (1,395 stems), but they constitute only 0.8 percent of the ground cover. Black spruce averages fewer seedlings (610), but covers 1.1 percent of the area. White-cedar is of some importance with 360 stems and 1.3 percent cover. This is the only community in the jack pine group in which white-cedar is present in any important amount. Other seedlings present are quaking aspen, paper birch, mountain-ash, and red maple.

The tall shrub class is not well developed; in fact only 6 of 10 stands in this type have tall shrubs present. The only tall shrub of any importance is bush honeysuckle, with only 840 stems and 0.2 BA (table 4, and fig. 14 in Appendix). Some stands of this community have a few stems of juneberry, and some have a few beaked hazel or fly honeysuckle. A few scattered individuals of other species are also present.

The low shrub class is also poorly represented. Some of the stands have a few prickly rose, late sweet blueberry, velvet-leaf blueberry, wintergreen and a few other species.

Herbs are not conspicuous, as indicated by a combined ground cover of only 3.9 percent for the five most important species. These are false lily-of-the-valley, twinflower, large-leaf northern aster, bunchberry, and wild sarsaparilla. In contrast to the herbs, the five most important mosses have a total of 59.2 percent ground cover. In addition to the prevalent modal species of the community listed, reindeer moss and other lichens are also important.

The community is similar to SAF cover type 6 – jack pine-black spruce – which is considered to be a

transition type in which jack pine is succeeded by the longer-lived and more tolerant black spruce. The quantity of black spruce is thought to increase in relation to the age of the stand (Society of American Foresters 1954). While time may be a major factor in determining the importance of black spruce, it is apparent that initial composition following disturbance is also significant. The stands described here are not yet old enough to show much more than initial composition and very early understory development. In our community the understory black spruce may be mostly suppressed individuals that originated following the initial disturbance and thus are the same age as the overstory trees. Species seeding into this community type must be able to penetrate the thick carpet of feather mosses. The presence of black spruce in the sapling and seedling classes of this community certainly supports the idea that black spruce will increase in time at the expense of the jack pine. The presence of large numbers of balsam fir seedlings, however, suggests that it may be transitional to a type where black spruce predominates but with balsam fir as a co-ordinate species (SAF cover type 7).

Aspen-Birch

The most conspicuous features of this community are the importance of quaking aspen trees, the presence of large numbers of quaking aspen and paper birch saplings, the well developed tall shrub layer of bush honeysuckle and beaked hazel, and the well developed herb component (fig. 6).

The community falls about midway on the Environment Index, being lower on the moisture gradient and somewhat higher on the nutrient gradient than most of the other communities (table 1). When last major fire disturbance is considered (Fire Disturbance Index), the aspen-birch community ranks eighth (table 1).

Slope positions are about equally divided among ridgetop, upper, mid-, and lower slopes. Slope averages 11 percent, with a range from 5 to 22 percent.

Soils are generally deep, with 36 to 40 inches common, although a few of the upper slope positions have as little as 12 inches.

Six of the stands examined originated from a fire in 1875, four from a fire in 1864, and a few from more recent fires.

This community contains the largest number of species (112), representing 30 families. One family is unique to this community – the Aristolocheaceae – represented by wild ginger. One family (the Orchidaceae represented by the round-leaf rein-orchid) is present in this community and not in the other broad-leaf community.

Figure 6. – The aspen-birch community has a conspicuous tall shrub layer.

The flora of this type has the largest Diversity Index and a relatively high Homogeneity Index (0.59) (table 2). The largest number of modal species for all communities are represented here with 27, 11 of which are also considered prevalent (table 3). Three of the prevalent modals are trees, saplings, and seedlings of quaking aspen. Paper birch saplings are also prevalent. Three tall shrubs are represented in this category: beaked hazel, green alder, and round-leaf dogwood. Four herbs are also in this category: large-leaf northern aster, Clinton's lily, bracken fern, and upland strawberry (table 3).

Quaking aspen is the most important of the 11 species in the tree class; it accounts for 102 stems and 42 BA out of the total of 190 stems and 80 BA for all trees. Of the others, only paper birch and balsam fir are of any importance.

The sapling class is codominated by quaking aspen with 102 stems and 4.3 BA, and paper birch with 110

stems and 3.5 BA. Balsam fir is present (43 stems and 1.4 BA), along with eight other species.

The tall shrub layer is very dense, with 49,000 stems and 22 BA. The two most important species are bush honeysuckle and beaked hazel, neither of which is heavily browsed in this community. Mountain maple and juneberry are less abundant, but they are browsed heavily (average Browse Index 1.8 and 1.3, respectively). Willow is even less important, but it is also heavily browsed with an average Index value of 2.2 (table 4). Ten other species are represented in the tall shrub class.

Low shrubs are not well represented in this community. Dewberry is the most common, while velvet-leaf blueberry is the most important with an average ground cover of 1 percent. Late sweet blueberry, raspberry, and a few others are also present.

The herbs are much more significant than mosses and lichens. The plant with the highest Commonness Index in the community is large-leaf northern aster with an average ground cover of 22 percent (its highest value for any community – fig. 16 in Appendix). Also important are wild sarsaparilla with 7 percent and Clinton's lily with 4 percent ground cover. False lily-of-the-valley and bunchberry are also common but show a lower average ground cover.

The nearest SAF cover type equivalent is type 16 (aspen) or type 11 (aspen-paper birch). These are generally recognized as pioneer vegetation types that eventually give way to a number of different communities. The specific succession depends on the region (USDA Forest Service 1965). In the BWCA this type will probably give way to some combination of balsam fir-spruce-paper birch. One often sees stands with an aspen-birch canopy and a well developed understory of balsam fir with scattered black and white spruce.

Twelve percent of the virgin vegetation stands in the sample were classified as aspen-birch community. The type will decrease with continued protection from disturbance. With this change in vegetation a corresponding change in wildlife species can be expected.

Maple-Aspen-Birch

The most outstanding feature of the community is the importance of red maple in all three size classes. It falls close to the aspen-birch community on the Environment Index. The community is slightly higher on the heat gradient and slightly lower on the nutrient gradient. It ranks seventh highest on the Fire Disturbance Index (table 1).

This type appears equally adapted to valley and upper slopes. No other community was found as frequently in valleys. Slope steepness is highly variable, averaging 12 percent but ranging from 2 to 35 percent.

Soil depths are generally 20 to 40 inches. A few of the stands located in the western BWCA at low elevations (about 1,320 feet) are on lacustrine deposits. These sediments are postulated to be from glacial Lake Agassiz, which may have extended into this area of northern Minnesota. Some of these stands have poor drainage.

The majority of stands in this type originated in the major fire years of 1864 and 1894. Two are located in areas believed to have last burned prior to 1800, one in 1759 and the other in 1784.

Thirty-four families represented by 104 species were encountered in these stands, with an average of 46 species per stand. The Tiliaceae family, represented by a few basswood seedlings, was found only in one stand. Several families are found here that are not encountered in the aspen-birch community: the Balsaminaceae, represented by jewelweed; the Equisitaceae, represented by horsetail; the Fagaceae, represented by red oak; and the Polygonaceae, represented by fringed bindweed.

Both the Index of Diversity (21.8) and Index of Homogeneity (0.49) are lower than in the aspen-birch community. The Index of Distinctness is 15.9, compared with 25.6 for the aspen-birch community (table 2).

Eighteen species are modal and seven of these are prevalent modal species (table 3). The only tree represented in this category is red maple, which tends to make this community distinct from the aspen-birch community. Three herb species in this category are also common in all the other communities: false lily-of-the-valley (present in 98 percent of all 106 stands sampled), starflower (present in 71 percent of all stands), and common twisted stalk (present in 46 percent of all stands). Ground-pine, a club moss, is also a modal prevalent species.

The tree class is dominated by quaking aspen with 123 stems and 56 BA, but red maple and paper birch are also significant. Smaller balsam fir trees are also present, as are a few black spruce and in some stands a few large white pine trees.

The sapling class dominance is shared by paper birch, red maple, and balsam fir with 112, 90, and 111 stems and 4, 3, and 4 BA respectively. Quaking aspen, black spruce, white spruce, and a few others are also represented in this class.

Red maple is the most numerous seedling present with an average of over 19,000 stems and 5 percent ground cover. Balsam fir is also important with 1,500 stems and 2 percent ground cover. Quaking aspen, paper birch, white pine, red oak, and mountain-ash are less important.

The tall shrubs are less numerous here than in the aspen-birch community, but are still conspicuous. Beaked hazel is the most common with about 7,600 stems, and mountain maple is second with 3,800 stems. Bush honeysuckle, juneberry, round-leaf dogwood, fly honeysuckle, and green alder are also present. Fly honeysuckle has the highest average Browse Index (1.5) for the community (table 4).

As in the aspen-birch community, the low shrubs are not very prominent. Only three are of much importance, late sweet blueberry, raspberry, and dewberry (fig. 15 in Appendix).

Herbs are more important than mosses and lichens. Some of the most important herbs have been mentioned as prevalent modal plants. Others that are important although not modal are large-leaf northern aster, Clinton's lily, wild sarsaparilla, bunchberry, violet, bracken fern, and goldthread. Many other species are also present. The majority of mosses are not feather mosses, although Schreber's feather moss and Dicranum moss are present.

The most similar SAF cover type might be type 11, if one considers the red maple as only an associate in the stand. The role of red maple in this community is difficult to ascertain, since the description is based on averages for the 15 stands that make up the community. In some of the stands the vigor of red maple may be due to the presence of fine-textured lacustrine soils, in others it may be due to valley slope position and perhaps slightly poorer subsoil drainage, and in still others due to nutrient flushing. In a few stands it may also be due to the age of the stand. Red maple may act as an intermediary species, living longer than aspen and being somewhat more tolerant (USDA Forest Service 1965); thus it replaces the aspen to a degree and is in turn replaced by fir and spruce. Whatever the reason, it certainly is a prominent feature of the stands of this community now, but will probably decrease in importance with time as fir and spruce become more important. About 15 percent of the upland virgin vegetation stands in the sample were classified as maple-aspen-birch community.

White Pine

Only six of the randomly selected stands compose the white pine community (fig. 7). The community ranks in the middle of both the Environment Index and the Fire Disturbance Index. While it is comparatively high on the moisture gradient, it ranks lower on the heat and nutrient gradients (table 1).

Figure 7. – A supercanopy of white pine and understory of balsam fir in a white pine community.

The stands are on midslope to ridgetop positions; slope averages 17 percent, but ranges from 4 to 45 percent. Stands are found on northeast- to south-facing slopes. Soil depth is generally more than 24 inches and often more than 40 inches above bedrock.

The stands comprising this community are slightly older than those in most of the communities described thus far. In some cases there are remnants of older stands present; for example, in one stand the main canopy originated following a fire in 1875 but there are individuals present from a previous stand that originated following a fire in about 1680. Most of the stands sampled originated following fires in 1864 or 1875.

A total of 80 species are present, with an average of 41 per stand. Twenty-three families are represented in the flora, none of which are unique to the community. The community does contain a few families that were not found in the red pine community. They are the Fabaceae, Rubiaceae, and Violaceae, as represented by lathyrus and vetch, bedstraw, and violet, respectively. Eight species are modal in the community, the following four of which are prevalent (table 3): white pine, bush honeysuckle (tall shrub), and wild sarsaparilla and wood anemone (herbs). Those modal but not prevalent are

prickly rose, pussytoes, meadow strawberry, and virgin's-bower. The Indices of Diversity and Homogeneity are not very different from those of the red pine community. The two communities do have different values on the Index of Distinctness (white pine community 10.0, red pine community 24.3) (table 2).

The tree class is strongly dominated by white pine, which has 188 trees and 125 BA. The second most important tree is balsam fir with 91 stems and 12 BA. Red pine is present in the tree class, but to a limited extent, with only 24 stems and 16 BA. Also present are paper birch, quaking aspen, white spruce, jack pine, red maple, and black spruce.

The sapling class is composed primarily of balsam fir with 166 stems and 6 BA. Paper birch, white pine, red maple, and quaking aspen each have from 10 to 20 stems per acre. Scattered individuals of other species are also present.

Balsam fir is also the dominant tree seedling, with over 15,000 stems per acre but only about 1 percent ground cover. White pine seedlings are present also, averaging over 2,000 stems and 0.3 percent ground cover. Quaking aspen, paper birch, red maple, white spruce, mountain-ash, black spruce, and also a few red pine seedlings are present.

The tall shrub class is made up mostly of bush honeysuckle, with over 12,000 stems per acre. This species is browsed more heavily here than in any of the other communities in which it occurs (table 4). This probably reflects its dominance of the tall shrubs; if an animal is present and must eat, it will utilize this less-preferred species. Beaked hazel averages over 3,000 stems per acre. Mountain maple and juneberry are also of some importance.

Velvet-leaf blueberry is the most common low shrub of the community, late sweet blueberry is second, and prickly rose, dewberry, raspberry, and wintergreen are less common. The low shrub layer is not well developed.

Herbs are more important than mosses and lichens in this community. Most important are large-leaf northern aster, false lily-of-the-valley, and bunchberry. Schreber's feather moss and Dicranum moss are present but of less importance than the other type of mosses.

This community is really a two-layered forest: a supercanopy of large, old white pine trees with scattered red pines and a lower layer of balsam fir trees and saplings. In the past this understory was probably periodically eliminated by ground fires passing through, perhaps killing some pines, and often establishing a seedbed for pine regeneration. It is possible that the fires were frequent enough so that an understory of fir never was as well established as it is today.

It is likely that the already small area occupied by this type will gradually decrease as the old pines die and are not replaced. This will occur slowly due to the longevity of white pine, unless the process is speeded up by the influence of white pine blister rust (*Cronartium ribicola*).

Species present in the tall shrub and herb layers, such as mountain maple, fly honeysuckle, goldthread, and bedstraw, are also characteristic of the fir-birch community type. This might be a reflection of the dense balsam fir understory in this community.

Red Pine

An attractive feature of this community is the presence of open stands of old, majestic red and white pines (fig. 8). This is perhaps the most aesthetically pleasing of all the communities for most visitors and campers.

Figure 8. – The understory in the red pine community has a dry, open aspect.

The community ranks comparatively low on the Environment Index, primarily due to its lower values on the moisture and nutrient gradients; it ranks ninth in the Fire Disturbance Index (table 1). This reflects, as in the white pine community, both the longevity of the species and also a general lack of disturbance of the stands for a long time.

Only four stands of this community were encountered in the random sample, so the resulting data are variable (and may be less reliable). These stands could be grouped with those of the white pine community to describe a red and white pine community type. The resulting tree data might be less variable, but the two communities are

sufficiently different in all regards to classify them separately.

The four stands all occupied different slope positions, ranging from ridgetop to lower slope. Slope was either quite steep or very moderate; two stands averaged 5 and 9 percent, and two averaged 31 and 35 percent. Soil was moderately deep – from 20 to 36 inches. Soil texture, soil water retention capacity, and soil depth were all lower than in the white pine community, and were lower than in most of the other communities also. Average pH was the lowest of all communities, and nutrient levels were also low. Distance to nearest water body of 5 acres or more was low; only the fir-birch community was more consistently near water. This may reflect the small sample number or it may reflect the importance of the protection water bodies can provide from certain fires. Such protection could alter the frequency of fire disturbance in these communities. Red pine produces a seed crop on the average of every 3 to 7 years (USDA Forest Service 1965). Thus, these areas may have received better protection than the general upland area during some of the past holocausts when even the fire resistance of mature red pine would not have prevented total destruction of the canopy. This is speculation of course, but it is supported by the casual observation that red pine stands occur more often around the shorelines of large lakes than farther inland.

The red pine community has the fewest species (67) of the forested communities, averaging 38 per stand. Twenty-five families are represented, which is about the same as in the other communities. No families are unique to this type, but several are not encountered in the white pine community. These are the Cupressaceae, Fagaceae, Myricaceae, and Orchidaceae, all of which are represented by species indicative of open, dry conditions.

Sixteen species are modal, nine of which are also prevalent (table 3). Among these are red pine (trees and saplings), white pine (saplings and seedlings), juneberry and sweet-fern (tall shrubs), velvet-leaf blueberry (low shrub), and cow-wheat (herb).

Tree-class dominance is shared by red pine with 157 trees and 147 BA and white pine with 90 trees and 58 BA. Paper birch, jack pine, red maple, and red oak are also present. Balsam fir, black spruce, white spruce, and white-cedar are less common.

Saplings are not abundant in this community, averaging only 66 stems per acre of all species. Although no one species really dominates, white pine is the most numerous with 22, followed by black spruce with 10, and red pine, paper birch, red maple, balsam fir, white-cedar, jack pine, red oak, and white spruce with six or less.

Red maple is the most numerous seedling with about 4,500 stems per acre, but only 0.8 percent ground cover. White pine averages 3,300 stems but has 1.9 percent ground cover. Black spruce, paper birch, quaking aspen, red oak, red pine, mountain-ash, white spruce, and a few others are also present but less important at this time.

The tall shrub layer is poorly developed, with juneberry most common (1,700 stems per acre) and also important as a browse source. Juneberry's Browse Index is higher here (2.5 of a possible 3.0) than in any of the communities in which it occurs (table 4). Beaked hazel averages more than 1,400 stems. Scattered individuals of other tall shrubs such as bush honeysuckle, green alder, sweet fern, low juniper, and willow are present.

Late sweet blueberry dominates the low shrub class with an average of 7 percent ground cover; velvet-leaf blueberry and wintergreen are also important with 5 and 3 percent, respectively. This is the only community in which bearberry is of much importance (fig. 15 in Appendix).

The mosses and lichens are more prominent than herbs. The ground layer appears rather open and scattered. The five most important herbs combined contribute 11 percent ground cover, while the five most important mosses and lichens together account for 26 percent ground cover. The most important plants in this layer are Dicranum moss and Schreber's feather moss, lichens other than the reindeer mosses, and herbs such as false lily-of-the-valley, large-leaf northern aster, and cow-wheat.

This community will apparently be present for some time with a gradual increase in black spruce, red maple, red oak, and to a lesser extent balsam fir and white spruce. These species may form a subcanopy below a supercanopy of the red and white pines. This community shows many of the same conditions as the jack pine (oak) community; that is, shrubs and lichens characteristic of dry conditions are prominent, and red maple and red oak are associates in the tree, sapling, and seedling classes. Yet the species important in the generally accepted succession for this area, black spruce, paper birch, white spruce, and balsam fir, are also present. The presence of white pine in the sapling and seedling classes indicates that white pine may continue to be present in the community to some extent (assuming that blister rust does not prevent it). There is little evidence to support the successional sequence developed by the USDA Forest Service (1965) – i.e., red pine replacing jack pine. The nearest equivalent is SAF forest cover type 15 (red pine).

Budworm-Disturbed

The budworm-disturbed community is characterized by dominance of balsam fir in the sapling and seedling

classes, and by the severe spruce budworm damage to most stands (fig. 9).

Figure 9. – Spruce budworm damage opens the canopy in the budworm-damaged community, resulting in a heavy growth of shrubs.

The community is located on the upper end of the Environment Index because of its comparatively high ranking in the moisture and nutrient gradients, and ranks tenth on the Fire Disturbance Index (table 1).

Most stands are found in north-facing mid- to upper slope position. Slope within the stands averages 10 percent, with a range from 5 to 18 percent.

Soils are commonly between 20 to 40 inches above bedrock. Almost every field description indicated numerous large boulders in the upper soil horizons, or more rock than soil in the soil profile.

Most of the stands were last disturbed by wildfire in 1864, although a few were older and a few younger.

A total of 102 species of plants are encountered, with an average of 46 per stand. Thirty-one families are represented, none of which are unique to the type. Eleven plants are modal, the following five of which are prevalent (table 3): white spruce (tree); raspberry and dewberry (low shrubs); and shinleaf and fringed bindweed (herbs). The Index of Distinctness is 11.1, as compared with 19.5 for the fir-birch community. The type is more homogeneous than the fir-birch community and also shows a greater degree of floral diversity (table 2). All of these differences reflect the presence of plant species that commonly occupy disturbed sites.

The tree class is not dominated by balsam fir but by black spruce, paper birch, and quaking aspen, with 65, 59, and 57 stems and 18, 12, and 31 BA, respectively. Balsam fir has only 35 stems and 6 BA. If the standing dead trees were considered, balsam fir would have an average density of 110 stems and 19 BA. Thus the larger balsam fir have been influenced strongly by the budworm. Six other species are also present in the tree class.

The sapling class is dominated by balsam fir, indicating the budworm has had less influence on the smaller balsam fir. Balsam fir saplings have an average density of 128 stems and 3 BA. Paper birch, with an average of 40 stems and 2 BA, and black spruce, with an average of 21 stems and 1 BA, are also important.

The seedling class is also dominated by balsam fir – 3,600 stems and 4.5 percent ground cover. Paper birch and red maple are numerically important with almost 1,500 and 1,200 stems, but they account for only 0.6 and 1.1 percent of the ground cover. Eight other species are present; two of these are mountain-ash with 160 stems and white-cedar with 15 stems per acre. In the fir-birch community these two are much more important.

The tall shrub class is well developed, with over 8,000 stems per acre. The most important tall shrub is beaked hazel with 3,000 stems and 1.6 BA, followed by bush honeysuckle with 2,000 stems and 0.4 BA. Mountain maple is also important with 1,500 stems and 0.9 BA. Other tall shrubs present are fly honeysuckle, juneberry, and green alder. Of those listed, mountain maple is most utilized by wildlife with an average Browse Index of 1.5 (table 4).

The low shrub class is well represented, with about twice as much ground cover as in the fir-birch community. This probably reflects the open conditions due to disturbance. The only communities having a larger average ground cover of low shrubs are the dry, open jack pine (oak) and red pine communities. Raspberry is the most important low shrub with almost 8 percent ground cover. Dewberry is also important with 1.1 percent ground cover. Of lesser importance are late sweet blueberry, velvet-leaf blueberry, prickly rose, and a few others.

The prominence of the herb and moss layer also reflects the disturbed conditions. The five most important species of mosses, lichens, and herbs combined account for more than 46 percent ground cover. A higher value is found only in the black spruce-jack pine community, due principally to the dense mat of mosses. In this community both mosses and herbs are important. The most important herbs are false lily-of-the-valley, bunchberry, large-leaf northern aster, twinflower, and Clinton's lily. The most important mosses are Schreber's feather moss and Dicranum.

About 9 percent of the stands in the upland virgin vegetation sample were classified as budworm-disturbed community. After the current budworm disturbance, a community similar to the fir-birch type will probably be regenerated. Our data support the observation of Ghent

et al. (1957) that there is an increase of formerly less-abundant shrub species following spruce budworm outbreaks. Bakuzis and Hansen (1965) also point out that competing shrub vegetation may delay balsam fir reproduction. Newfoundland conditions studied by W. M. Robertson (Candy 1951) showed balsam fir natural regeneration in softwood forest cover types to be 2,000 stems per acre. Following disturbance by cutting he found 2,800 stems, and after disturbance by fire only 35 stems per acre. While there is a well developed shrub layer in the budworm-damaged stands, there is probably an adequate stocking (average of 76 percent on milacre plots) and density (3,600 stems per acre) of balsam fir to regenerate the community.

Fir-Birch

The most unique features of this community are (1) its proximity to water, (2) the importance of balsam fir in all three tree size classes, (3) the importance of mountain maple as a tall shrub, and (4) the poor development of the ground cover flora.

The community ranks high on the Environment Index. It has a relatively high rating on the moisture gradient primarily due to soil depth, and ranks high on the heat gradient due to slope position and nearness to water. It ranks high on the nutrient gradient due to high calcium content of the B soil horizon. This community ranks eleventh on the Fire Disturbance Index (table 1). While stands are old (long period since fire disturbance), they are not quite as old as those of the white-cedar community.

Stands tend to be on lower slopes, and occasionally on mid- to upper slopes at lower elevations. Slope within the stands averages 12 percent, ranging from 5 to 30 percent.

Soils are deep (for this area), ranging from 20 to more than 40 inches above bedrock. Distance from stand to nearest water body 5 acres or larger averages about 70 meters and ranges from 20 to 135 meters. This community is on the average closer to water than any of the others, the next closest being the red and white pine communities.

Thirty families represented by 86 species were encountered, with an average of 42 species per stand. The families Boraginaceae and Taxaceae were encountered only in this and the white-cedar community. Thirteen species are modal and eight of these are prevalent (table 3). Balsam fir (trees and saplings), and paper birch (trees and seedlings) are among these. One tall shrub (mountain maple) is prevalent, as are bedstraw, stiff club-moss, and mosses other than hairycap moss and feather mosses.

Balsam fir, with 154 stems and 26 BA, and paper birch, with 106 stems and 27 BA, are codominant in the tree class. Black spruce and white-cedar are less important with 31 and 23 stems and 9 and 11 BA. White spruce, quaking aspen, white pine, mountain-ash, and jack pine are also present.

Balsam fir dominates the sapling class with 260 stems and 8 BA. Paper birch is important with 77 stems and 3 BA. Black spruce, white-cedar, quaking aspen, white spruce, and mountain-ash are of less importance.

Balsam fir also dominates the seedling class with almost 10,000 stems per acre and about 6 percent ground cover. Paper birch is also important in this class with 2,000 stems and 0.5 percent ground cover. Mountain-ash and white-cedar are rather important with 550 and 1,500 stems and 0.5 and 0.4 percent ground cover.

The well-developed tall shrub class has over 9,000 stems per acre, and unlike this class in most of the other communities, it is dominated by mountain maple both in numbers (6,600 stems) and in basal area (4.2). Beaked hazel is of secondary importance with 1,400 stems and 0.8 BA. Fly honeysuckle, bush honeysuckle, juneberry, round-leaf dogwood, green alder, ground-hemlock, and chokecherry are also present. Of special interest is ground-hemlock, which was encountered only in this and the white-cedar community. Here it is of minor importance. A number of the tall shrubs noted above were utilized by wildlife (table 4). Browse Index values averaged 1.4 for mountain maple, 1.5 for ground-hemlock, 1.5 for green alder, and 1.5 for juneberry.

The low shrub class is poorly developed in this type. It is dominated by raspberry, which accounts for an average of 4.0 percent ground cover. The total ground cover for all the low shrubs is only 5.7 percent, thus raspberry (an indicator of disturbance) may reflect the smaller amount of spruce budworm damage present in stands of this community.

The five most common mosses, lichens, and herbs average only 32 percent ground cover. Only the white-cedar community type has a lower value. This probably reflects the low light penetration and perhaps increased precipitation interception by the dense canopy. Mosses and lichens are more prominent than herbs; the mosses, other than hairycap or feather mosses, average 11.5 percent, Schreber's feather moss averages 9.3 percent, and Dicranum moss averages 1.5 percent ground cover. Large-leaf northern aster, bunchberry, false lily-of-the-valley, twinflower, violet, wild sarsaparilla, Clinton's lily, bed-

straw, and goldthread are the most prominent herbs.

About 8 percent of the upland virgin vegetation stands sampled were classed as fir-birch community. The type could increase considerably as other communities progress along the evident successional trends and as severely budworm-damaged stands recover. On the other hand, the type could temporarily decrease with a renewal of the current budworm outbreak. Any decrease will eventually be compensated for by succession in other types and eventual recovery of damaged stands. The high tolerance of the major species encountered in this community indicates the capability of the type to maintain itself (fig. 10)

White-Cedar

An unusual characteristic of this community is the dominance of northern white-cedar on an upland site. White-cedar is more common on lowland or poorly drained sites in this area.

The community ranks highest on the Environment Index. It is high on the heat gradient due primarily to low total annual insolation and also to high values for aspect, slope position, and distance to water. It is also high on the nutrient gradient due to its high calcium content in the B soil horizon. The white-cedar community ranks twelfth on the Fire Disturbance Index (table 1).

Average elevation is the highest of all communities at 1,802 feet (range is 1,530 to 1,930 feet). The stands are found mostly on north- to northeast-facing slopes at lower slope positions. Slope gradient averages 19 percent and ranges from 5 to 39 percent.

Soils are generally deep, between 20 and 40 inches above bedrock. Boulders are numerous in some of the stands, but no bedrock outcrop is apparent.

All of the stands were extensively burned prior to 1871, and one dated back to 1680.

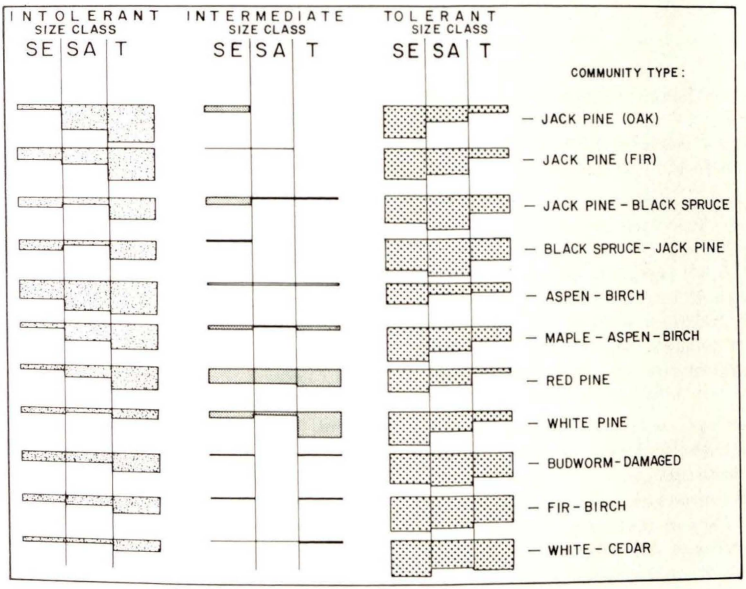


Figure 10. — Average importance value of tree species within each community (forested) in three tolerance classes and three size classes. T = tree size class; SA = sapling size class; and SE = seedling size class. Tolerance classes are a combination of those of Graham (1954) and Baker (1949), as follows:

Tolerant: balsam fir, basswood, black spruce, mountain-ash, red maple, white-cedar, white spruce.

Intermediate: black ash, red oak, white pine.

Intolerant: bigtooth aspen, jack pine, paper birch, quaking aspen, red pine, tamarack.

Twenty-eight families represented by 85 species (an average of 38 species per stand) were encountered. Two families are unique to this type: the Ophioglossaceae and Oxalidaceae. Two families are found only here *and* in the fir-birch community: the Boraginaceae and Taxaceae.

Twenty-five (second highest of all communities) modal species are found, 13 of which are prevalent (table 3). Six of these are tree species: white-cedar (trees, saplings, and seedlings); balsam fir, mountain-ash, and white spruce (seedlings); fly honeysuckle and ground-hemlock (tall shrubs); thimbleberry (low shrub); oak fern (fern); bishop's-cap and violet (herbs); and Hylocomium, a feather moss.

The community ranks second highest on the Index of Distinctness, following the lichen community (table 2).

The tree class is dominated by white-cedar with 214 stems and 83 BA. Paper birch and balsam fir are of secondary importance, with 75 and 77 stems and 28 and 17 BA, respectively. White spruce, quaking aspen, white pine, black spruce, mountain ash, and red pine are also present.

White-cedar and balsam fir codominate the sapling class with 169 and 177 stems and 6 and 5 BA. Paper birch, white spruce, mountain-ash, black spruce, white pine, jack pine, and quaking aspen are also found.

Balsam fir dominates the seedling class numerically with more than 14,000 stems per acre, but comprises only 1.7 percent ground cover. White-cedar is less abundant with slightly over 2,000 stems per acre and a ground-cover value of 1.2 percent. Mountain-ash is also important with 800 stems per acre and 0.7 percent ground cover. Paper birch, white spruce, white pine, quaking aspen, red maple, and black spruce are of minor importance.

The tall shrub layer is fairly well developed, with over 12,000 stems per acre; the largest contributors to this total are mountain maple and ground-hemlock, with 5,661 and 4,317 stems each – the highest values for these species in any community (fig. 14 in Appendix). Species common in most of the other communities, such as bush honeysuckle, juneberry, willow, beaked hazel, and green alder, are less abundant here. Mountain maple and ground-hemlock are evidently highly utilized by wildlife, as indicated by the average Browse Index values of 1.7 and 2.1 (table 4).

The low shrub layer is poorly developed; only the black spruce-jack pine community has a sparser low shrub cover. Thimbleberry and dewberry are the only important species.

The herb layer is also sparse; the five most important mosses, lichens, and herbs only total 20-percent ground cover, the lowest of all the forested communities. False lily-of-the-valley, bunchberry, starflower, large-leaf northern aster, Clinton's lily, and violet are the most important herbs.

The white-cedar community type seems to be best developed on the eastern half of the BWCA, on fairly steep north-facing slopes of the Rove Slate Geological Formation. These sites are on the north slopes of east-west trending ridges, which parallel elongated lakes. They may have historically had a lower fire frequency than most of the BWCA, and thus contain more mature forest.

The data suggest that the community will remain much the same for a long period of time. White-cedar is a rather long-lived species. Balsam fir may become more important if it is not disturbed by the spruce budworm. Several factors can influence this community. Fire, of course, would set the type back, but the influence of the spruce budworm on balsam fir and the influence of white-tailed deer on the white-cedar reproduction may also be important. White-cedar is a preferred winter browse species; in many areas white-cedar stands are used by deer as winter yards.

DISCUSSION

Community Dynamics

Plant communities are dynamic; they are constantly changing and cannot be frozen in time, either as they are now, or as they were at some time in the past. In the past the BWCA was mapped as part of the Northern Pine Belt by Sargent (1884), the Lake Forest Region by Weaver and Clements (1938), and as part of the Hemlock-White Pine-Northern Hardwood Forest by Nichols (1935) and Braun (1950). Nichols referred to the region as a "mesophytic forest comprising a mixture of evergreen coniferous and deciduous broadleaf trees." Braun characterized the region as a "pronounced alternation of deciduous, coniferous and mixed forest communities." The area has been considered as a transitional zone between the boreal and eastern deciduous forest formations, or as a formation in itself composed of one or more associations (Flaccus and Ohmann 1964).

Maycock and Curtis (1960) studied the boreal conifer-hardwood forests of the Great Lakes Region. They selected for study only stands that contained white spruce as an indicator of boreal conditions. Based on data from Minnesota, Wisconsin, Michigan, and Ontario, they concluded the Great Lakes Forest Region to be

composed of both boreal and deciduous forest species, with boreal species predominating toward the north.

Published reports of plant community studies conducted wholly within the BWCA are nonexistent. But a number of studies have been concerned specifically with vegetation of northeastern Minnesota and have been based on data or observations in or near the BWCA. Among the earliest were those by Bergman and Stallard (1916) and Bergman (1924). They concluded the area to be a pine climax with primary (both xerarch and hydrarch) and secondary succession leading to the pine climax. This conclusion is repeated by Braun (1950). Waring (1959) postulated a mesophytic climax of white and red pine above an understory of balsam fir and spruce. Waring's conclusion in part supports Cooper's (1913) concept of balsam fir-white-spruce-white birch climax vegetation for the general area.

Buell and Niering (1957) included three fir-spruce stands located within the BWCA in their study of fir-spruce-birch forests of northern Minnesota. They found that all three stands from the BWCA had been recently occupied by pine forests.

Based on our study of the virgin upland vegetation of the BWCA, we believe that with continued protection from disturbance the following dynamic changes in the plant communities will take place:

The lichen community will become more woody; that is, the shrub layer will become more important, and a poorly developed scrubby tree canopy will start to form. As soil development proceeds, the sites could probably support a jack pine-black spruce type and eventually a black spruce-feather moss community.

The jack pine-dominated communities where black spruce is important and also the red pine community will probably become dominated by black spruce. They will perhaps eventually become a black spruce-feather moss type with a poorly developed shrub or herb component. The successional trend to more tolerant species in the communities can be seen in the composition of the sapling and seedling classes (fig. 10).

The jack pine community where fir is important and the other communities (not already fir-dominated) seem to be headed toward dominance by balsam fir, paper birch, white-cedar, white spruce, and to a lesser extent black spruce. A scattered supercanopy of white and/or red pine may also be present. The tall shrub layer may be dominated by mountain maple and fly honeysuckle, the low shrubs by dewberry, and the ground flora by scattered mosses and representative herbs such as false lily-of-the-valley, bunchberry, large-leaf northern aster, starflower, wild sarsaparilla, goldthread, twinflower, and bedstraw.

A method of making these predictions more quantitative is badly needed. We have a study underway to accomplish this for the tree species. Based on current composition of tree, sapling, and seedling components, we hope to be able to predict percent composition of tree species in a stand 50 years into the future.

The community changes discussed above can be interrupted by many kinds of disturbances – wildfire, windstorms, insect epidemics, disease, the influence of animals such as the white-tailed deer and beaver, or indirectly through the influence of predators such as the fisher (*Martes pennati* Erxleben), marten (*Martes americana* Turton), or timber wolf (*Canis lupus* L.). Animal populations shift with the changes in plant communities. Herbivores depend directly on the kinds of plants in the communities and predators are affected by changes in herbivore populations.

Maintenance of virgin (natural) plant communities in all stages of succession is best accomplished by allowing all of the natural disturbance factors to operate by chance. However, some factors cannot always be allowed to operate because they may threaten property adjacent to a wilderness area, or endanger visitors in the area. The alternative might be to introduce controlled disturbance.

If the policy is to maintain the area as natural as possible, the only disturbance factor that is ecologically and economically feasible seems to be the controlled use of fire (Heinselman 1970). A research program aimed at determining the ecological effects of prescribed fires in standing forest is needed to provide the basis for such an operational community-maintenance program.

Community Comparisons

Comparison of the cluster analysis dendrogram with the principal components analysis led to the selection of 12 community types. The efficiency of the cluster analysis at the selected level is 59 percent, implying that almost 60 percent of variability in the sample is accounted for by the heterogeneity of the 12 community types (Orloci 1967). The first three components of the principal components analysis account for 46 percent of the variation. The vegetation is apparently quite variable, even though it is all upland natural vegetation in a relatively small region.

Although the names assigned to the community types reflect important features of the communities (usually

the dominant tree or trees), they are arbitrary and are provided primarily for ease of discussion and identification.

The prevalent modal species for each community are listed in table 3. A modal species is one that has its maximum presence value in a given community. If the species is, by presence ranking, above the average for all species in the community, it is also considered a prevalent species. According to Curtis (1959), this is equivalent to the "floristic-characteristic species combination" of Raabe (1952). The number below each list of prevalent modal species (table 3) is the number of other modal species in the community. These species occurred less frequently in the community and thus are not considered prevalent.

Community comparisons are shown in table 2. The number of stands and percent of all stands sampled for each community reflects in a general way a real distribution of each of the types within the region, because the stands were randomly selected. Although the community types presented here are not directly equivalent to the "cover types" designated by the Society of American Foresters, the areas occupied by our community types and the corresponding "cover types" reported for the Boundary Waters Canoe Area in 1948 (Management Plan for the Roadless Area, Superior National Forest) are fairly similar.

The number of species varies from 32 in the lichen community to 112 in the aspen-birch community. These figures are not absolute because certain plants were treated as groups rather than at the specific level. Plants in this category include mosses other than feather mosses, Dicranum, and hairycap moss, lichens other than the reindeer mosses and peltigera, grasses, and sedges.

Floristic analysis by stand and community shows a minimum of 132 species encountered in the sample. These represent 47 different families. No single family shows a clear predominance, but there is a definite difference in importance of some families. Six families contributed 42 percent of all the species. These are the Ericaceae, Rosaceae, Pinaceae, Polypodiaceae, Compositae, and the Caprifoliaceae. Twelve families contributed 61 percent of the total species composition. In addition to those already listed they are the Liliaceae, Lycopodiaceae, Betulaceae, Salicaceae, Cladoniaceae, and the Ranunculaceae families. In terms of frequency of occurrence in the sample plots and points, the families contributing most were the Dicranaceae, Gramineae, Betulaceae, Aceraceae, Liliaceae, Hypnaceae, Pinaceae, and the Primulaceae (table 18 in Appendix). The number of families represented in each of the communities ranges from 19 for the lichen to 34 in the maple-aspen-birch community. A chi-square test failed to show any significant difference in number of families represented in each of the communities.

The Index of Diversity, a measure of floral richness, shows the flora of the lichen community to be least diverse and the flora of the aspen-birch community most diverse (table 2).

It is important to know how closely stands within a community type resemble each other – that is, how homogeneous the community type is. The Index of Homogeneity shows this. In the BWCA the values range from 0.46 for the jack pine (oak) community to 0.99 for the lichen community (table 2). In Wisconsin, Curtis (1959) reported a range from 0.44 for the wet-mesic southern forest community to 0.65 for the dry-mesic southern forest community, with the boreal forest community rating 0.58. This again indicates that even though the stands within a community type are more similar to each other than to stands of other communities, there is still much variability.

The Index of Distinctness provides some indication of the uniqueness of each community. The number of modal prevalent species is expressed as a percentage of the total number of prevalent species for a community (Curtis 1959). This is based on the assumption that if many of the most common species have optimum presence values in a particular community, that community should be more distinct than one in which the most common species do not show an optimum presence. The Distinctness Index ranges from 7.3 for the jack pine-black spruce community to 50.0 for the lichen community (table 2). This compares with a range of 10.2 to 56.1 for all forest community types in Wisconsin (Curtis 1959). This Index must be cautiously interpreted; for example, Curtis (1959) shows an Index of 56.1 for dry-mesic southern forest and 56.3 for bracken-grassland communities, and again, 28.6 for lake-beach and 29.0 for wet-mesic prairie communities. However, even though the Index values are similar in these two sets of examples, the community types are quite distinguishable from each other. Comparisons must be restricted to community types which appear similar physiognomically, have similar floras, and therefore might be expected to have similar Index values. Curtis (1959) recognized this when he referred to distinctness of *related communities.* As an example, the jack pine (fir) and the jack pine (oak) communities of our study appear similar but have Index values of 8.9 and 17.9, respectively. Another example

might be the apparently similar maple-aspen-birch and aspen-birch communities with Distinctness Index values of 15.9 and 25.6, respectively (table 2). We conclude that, in terms of this Index, the plant communities as classified are rather distinct entities.

Another way of comparing the communities is to test for statistical differences in species characteristics. The only common species not showing a statistically significant difference among communities is paper birch seedlings. Two species, wild sarsaparilla and fly honeysuckle, are significantly different only at the 5-percent level of probability. While this is more evidence that the communities as classified are indeed unique, it does not show which (or if all) communities are different. This same idea is shown graphically in figures 11 through 17 in the Appendix in which importance of either density values (tree and tall shrub species) or percent ground cover values (low shrubs and herbs) for the most important species are depicted.

The Environment and Fire Disturbance Indices are simplified attempts to show some exceedingly complex relationships (table 1). Many other factors could have been included and some used as readily omitted. The Environment Index value differences among communities are low and are probably not even statistically significant. Yet, the position of most of the communities on this Index and especially on the Fire Disturbance Index (even if fortuitous) makes sense ecologically. The changes in ranking that occur when the period since fire disturbance is considered are especially interesting. We believe this indicates that the history of periodic disturbance may be more important than many environmental factors over a relatively small region such as the virgin vegetation area of the BWCA. We also feel, but cannot show, that the species composition prior to the last major fire disturbance is also important. The environmental factors that do seem important may be related to the history of disturbance also. For instance, distance to nearest water body of 5 acres or larger may reflect protection from certain types of fires. Nutrient levels are thought to increase as vegetation progresses toward a climax. This is certainly related to periodicity of disturbance. Slope aspects and positions that are more favorable microclimatically for vegetation may be less favorable in terms of fire disturbance. These examples all point to the interrelationship of environmental factors, of which fire is but one, and it is doubtful that any one or two characteristics can change without modifying others (Billings 1952). We conclude that differences in the structure and composition of the plant communities of the virgin vegetation of the BWCA are primarily due to differences in the time elapsed since the last major wildfire disturbance and the composition of the vegetation present at the time of that disturbance. Thus we see major changes occurring in the plant communities due to the fire protection policy of the Forest Service.

The significance of man's influence on ecosystems through disruption of the periodic natural disturbances has been most recently expressed by Loucks (1970). He hypothesized that evolution in ecosystems has brought about an adaptation to a repeated pattern of changing environments in which species replacement is repeated over and over in time. The periodicity of this is thought to be several centuries in the northern lake forest, where he estimates white pine to have been recycled at intervals of 300 to 400 years. It is possible that if the virgin vegetation becomes primarily fir-spruce-birch forest, the spruce budworm could replace wildfire as a recurring natural cyclic disturbance. This would not, however, set community succession as far back as fire. According to Loucks (1970), modern man's halting of the random rejuvenation of the ecosystem through periodic disturbance is the greatest upset of the ecosystem of all time.

LITERATURE CITED

Ashby, W. R. 1960. Design for a brain. Ed. 2. 286 p. New York: Wiley.

Baker, F. S. 1949. A revised tolerance table. J. Forest. 47: 179-181.

Bakuzis, E. V. 1959. Synecological coordinates in forest classification and in reproduction studies. Univ. Minn. Ph.D. thesis. 242 p. Ann Arbor: Microfilm and Xerox Publ. Univ. Microfilms.

Bakuzis, E. V., and Hansen, H. L. 1965. Balsam fir, a monographic review. 445 p. Minneapolis: Univ. Minn. Press.

Bergman, H. F. 1924. The composition of climax plant formations in Minnesota. Pap. Mich. Acad. Sci. 3: 51-60.

Bergman, H. F., and Stallard, H. 1916. The development of climax formations in northern Minnesota. Minn. Bot. Studies 4: 333-378.

Billings, W. D. 1952. The environmental complex in relation to plant growth and distribution. Quart. Rev. Bibl. 27: 251-265.

Braun, E. L. 1950. Deciduous forests of eastern North America. 596 p. Philadelphia: Blakiston.

Buell, M. F., and Niering, W. A. 1957. Fir-spruce-birch forests in northern Minnesota. Ecology 38: 602-610.

Candy, R. H. 1951. Reproduction on cut-over and burned-over land in Canada (east of the Rocky Moun-

tains). Can. Dep. Resources and Dev. For. Res. Div. Silv. Res. Note 92, 224 p.

Cayford, H. H., Chrosciewicz, Z., and Sims, H. P. 1967. A review of silvicultural research in jack pine. Can. Dep. Forest. And Rural Dev. Forest. Br. Dep. Publ. 1173, 225 p.

Cooper, W. S. 1913. The climax forest of the Isle Royale, Lake Superior, and its development. Bot. Gaz. 55: 1-44, 115-140, 189-235.

Cottam, G., and Curtis, J. T. 1956. The use of distance measures in phytosociological sampling. Ecol. 37: 451-460.

Cunningham, G. C. 1958. Forest flora of Canada. Can. Dep. N. Affairs and National Resources Forest. Br. Bull. 121, 144 p.

Curtis, J. T. 1959. The vegetation of Wisconsin. 657 p. Madison: Univ. Wis. Press.

Fernald, M. L. 1950. Gray's manual of botany. Ed. 8. 1,632 p. New York: American Book Co.

Flaccus, E., and Ohmann, L. F. 1964. Old growth northern hardwood forests in northeastern Minnesota. Ecology 45: 448-459.

Frank, E. C., and Lee, R. 1966. Potential solar beam irradiation on slopes. Tables for 30° to 50° latitude. USDA Forest Serv. Res. Pap. RM-18, 116 p. Rocky Mountain Forest and Range Exp. Sta., Fort Collins, Colo.

Ghent, A. W., Fraser, D. A., and Thomas, J. B. 1957. Studies of regeneration in forest stands devastated by the spruce budworm. Forest Sci. 3: 184-208.

Gleason, H. A. 1963. The new Britton and Brown illustrated flora of northeastern United States and adjacent Canada. 595 p. New York: Hafner Publishing Co., Inc.

Graham, S. A. 1954. Scoring tolerance of forest trees. Mich. Forest. 4: 2 p.

Grigal, D. F. 1968. The relationship between plant communities and soils in northeastern Minnesota. Univ. Minn. Ph.D. thesis. 127 p. Ann Arbor: Microfilm and Xerox Publ. Univ. Microfilms.

Grigal, D. F., and Arneman, H. F. 1970. Quantitative relationships among vegetation and soil classifications from northeastern Minnesota. Can. J. Bot. 48: 555-566.

Groenewoud, H. van. 1965. Ordination and classification of Swiss and Canadian coniferous forests by various biometric and other methods. Ber. geobot. Inst. EtH. Stiftg. Rubel, Zurich 36: 28-102.

Grout, A. J. 1928-40. Moss flora of North America. Vol. 1-3, Publ. by author, New Fane, Vt.

Hale, M. E., Jr., and Culbertson, W. L. 1965. A third check list of the lichens of the continental United States and Canada. The Bryol. 69: 141-182.

Heinselman, M. L. 1969. Diary of the canoe country's landscape. Naturalist 20: 2-13.

Heinselman, M. L. 1970. Preserving nature in forested wilderness areas and national parks. Nat. Parks and Conserv. Mag. 44: 8-14.

LeBarron, R. K. 1948. Silvicultural management of black spruce in Minnesota. U.S. Dep. Agr. Circ. 791, 60 p.

Lakela, O. 1965. A flora of northeastern Minnesota. 541 p. Minneapolis: Univ. Minn. Press.

Little, E. L., Jr. 1953. Checklist of native and naturalized trees of the United States (including Alaska). U.S. Dep. Agr. Handb. 41, 472 p.

Loucks, O. L. 1970. Evolution of diversity, efficiency, and community stability. Amer. Zool. 10: 17-25.

Maycock, P. F., and Curtis, J. T. 1960. The phytosociology of boreal conifer-hardwood forests of the Great Lakes Region. Ecol. Monog. 30: 1-35.

Nichols, G. N. 1935. The hemlock-white pine-northern hardwood region of eastern North America. Ecology 16: 403-422.

Ohmann, L. F., and Ream, R. R. 1971. Wilderness ecology: A method of sampling and summarizing data for plant community classification. USDA Forest Serv. Res. Pap. NC-49, 14 p. N. Cent. Forest Exp. Sta., St. Paul, Minn.

Oosting, H. 1956. Plant communities. 389 p. San Francisco: Freeman.

Orloci, L. 1966. Geometric models in ecology. I. The theory and application of some ordination methods. J. Ecol. 54(1): 193-215.

Orloci, L. 1967. An agglomerative method for classification of plant communities. J. Ecol. 55: 193-205.

Orloci, L. 1968. Information analysis in phytosociology: partition, classification, and prediction. J. Theor. Biol. 20: 271-284.

Raabe, E. W. 1952. Über den Affinitatswert in der Pflanzensoziologie. Vegetatio 4: 53-68.

Ream, R. R., and Ohmann, L. F. 1971. Analysis of wilderness ecosystems. Int. Symp. Statist. Ecol. (In press).

Rowe, J. S. 1959. Forest regions of Canada. Can. Dep. N. Affairs and National Resources Forest. Br. Bull. 123, 71 p.

Sargent, C. S. 1884. Forests of North America. 612 p. USDI Census Office, Washington, D. C.

Society of American Foresters. 1954. Forest cover types of North America (exclusive of Mexico). Soc. Amer. Forest., Washington, D. C. 67 p.

USDA Forest Service. 1965. Silvics of forest trees of the United States. U.S. Dep. Agr., Agr. Handb. 271, 762 p.

Waring, R. H. 1959. Some characteristics of the upland forest types in the rock outcrop area of northeastern Minnesota. M.S. thesis on file at Univ. Minn. 49 p.

Weaver, J. E., and Clements, F. E. 1938. Plant ecology. 601 p. New York: McGraw-Hill.

Whittaker, R. H. 1962. Classification of natural communities. Bot. Rev. 28: 1-239.

APPENDIX

Species Nomenclature and Occurrence

Scientific and family names for tree species follow Little (1953); those for shrubs and herbs follow Gleason (1963) with a few exceptions, in which either Lakela (1965) or Fernald (1950) are used. Scientific names for lichens follow Hale and Culbertson (1965), and those for mosses follow Grout (1928-1940).

The first two data columns of table 5 represent the number and percent of stands in which the species occurred. The last two data columns represent the average percent frequency of occurrence in sample points or plots, and the maximum percent of frequency of occurrence in any stand.

Table 5. – Scientific names and occurrence for species in the virgin plant communities of the BWCA

Nomenclature			Presence		Frequency	
Common name	Scientific name	Family name	Number of stands	Percent of stands	Average	Maximum
TREES						
Balsam fir	Abies balsamea (L.) Mill.	Pinaceae	70	66.0	26.1	100
Balsam poplar	Populus balsamifera L.	Salicaceae	1	.9	.1	5
Bigtooth aspen	Populus grandidentata Michx.	Salicaceae	11	10.4	.8	10
Black ash	Fraxinus nigra Marsh.	Oleaceae	1	.9	.1	5
Black spruce	Picea mariana (Mill.) B.S.P.	Pinaceae	71	67.0	28.7	100
Jack pine	Pinus banksiana Lamb.	Pinaceae	60	56.6	31.6	100
Mountain-ash	Sorbus americana Marsh.	Rosaceae	4	3.8	.5	30
Paper birch	Betula papyrifera Marsh.	Betulaceae	85	80.2	29.2	100
Quaking aspen	Populus tremuloides Michx.	Salicaceae	72	67.9	29.3	100
Red maple	Acer rubrum L.	Aceraceae	33	31.1	9.5	90
Red oak	Quercus rubra L.	Fagaceae	6	5.7	.8	35
Red pine	Pinus resinosa Ait.	Pinaceae	19	17.9	6.2	100
White-cedar	Thuja occidentalis L.	Pinaceae	22	20.8	10.8	100
White pine	Pinus strobus L.	Pinaceae	34	32.1	12.2	100
White spruce	Picea glauca (Moench) Voss.	Pinaceae	56	52.8	7.4	50
SAPLINGS						
Balsam fir			74	69.8	39.5	100
Balsam poplar			1	.9	.1	5
Bigtooth aspen			10	9.4	.8	20
Black ash			3	2.8	.2	10
Black spruce			68	64.2	31.2	100
Jack pine			28	26.4	7.7	100
Mountain-ash			18	17.0	1.1	20
Paper birch			89	84.0	38.6	100
Quaking aspen			56	52.8	16.1	100
Red maple			38	35.8	14.1	100
Red oak			10	9.4	1.8	35
Red pine			6	5.7	1.4	40
White-cedar			16	15.1	7.0	100
White pine			21	19.8	4.5	80
White spruce			42	39.6	4.5	45
SEEDLINGS						
Balsam fir			82	77.4	37.5	100
Basswood	Tilia americana L.	Tiliaceae	1	.9	.1	5
Bigtooth aspen			2	1.9	.1	10
Black ash			4	3.8	.5	20
Black spruce			41	38.7	6.1	50
Jack pine			2	1.9	.2	15
Mountain-ash			49	46.2	9.6	80
Paper birch			75	70.8	13.4	70
Quaking aspen			74	69.8	16.6	70
Red maple			53	50.0	25.8	100
Red oak			14	13.2	4.2	85
Red pine			6	5.7	.3	5
Tamarack	Larix laricina (DuRoi) K. Koch.	Pinaceae	1	.9	.1	5
White-cedar			17	16.0	4.1	65
White pine			41	38.7	9.3	95
White spruce			37	34.9	3.6	35
TALL SHRUBS						
Beaked hazel	Corylus cornuta Marsh.	Betulaceae	82	77.4	31.9	100
Bebb willow	Salix bebbiana Sarg.	Salicaceae	26	24.5	2.3	30
Bush honeysuckle	Diervilla Lonicera Mill.	Caprifoliaceae	86	81.1	36.6	100
Chokecherry	Prunus virginiana L.	Rosaceae	8	7.5	.4	10
Downy arrow-wood	Viburnum rafinesquianum Schult.	Caprifoliaceae	7	6.6	.8	20
Elderberry	Sambucus spp.	Caprifoliaceae	1	.9	.1	5
Fly honeysuckle	Lonicera canadensis Marsh.	Caprifoliaceae	63	59.4	8.3	45
Green alder	Alnus crispa (Ait.) Pursh.	Betulaceae	39	36.8	7.9	80
Ground-hemlock	Taxus canadensis Marsh.	Taxaceae	6	5.7	2.4	100
Hairy climbing honeysuckle	Lonicera hirsuta Eat.	Caprifoliaceae	10	9.4	1.5	42
Juneberry	Amelanchier spp. Medic.	Rosaceae	79	74.5	14.5	60
Low juniper	Juniperus communis L.	Cupressaceae	4	3.8	.5	30
Mountain fly honeysuckle	Lonicera villosa (Michx.) R.dS.	Caprifoliaceae	1	.9	.1	15
Mountain maple	Acer spicatum Lam.	Aceraceae	62	58.5	27.3	95
Pincherry	Prunus pensylvanica L.F.	Rosaceae	14	13.2	.9	20
Red osier	Cornus stolonifera Michx.	Cornaceae	3	2.8	.3	20
Round-leaved dogwood	Cornus rugosa Lam.	Cornaceae	28	26.4	5.4	60
Speckled alder	Alnus rugosa (DuRoi) Spreng.	Betulaceae	2	1.9	.1	5
Spiraea	Spiraea spp. L.	Rosaceae	1	.9	.1	5
Sweet fern	Comptonia peregrina B.&B., Small, Rydb.	Myricaceae	6	5.7	1.3	70
Willow	Salix spp. L.	Salicaceae	8	7.5	1.4	45

(Continued on next page)

Table 5 continued

Nomenclature			Presence		Frequency	
Common name	Scientific name	Family name	Number of stands	Percent of stands	Average	Maximum
LOW SHRUBS						
Bearberry	Arctostaphylos Uva-ursi (L.) Spreng.	Ericaceae	5	4.7	0.5	15
Creeping snowberry	Gaultheria hispidula (L.) Muhl.	Ericaceae	11	10.4	.6	10
Current	Ribes spp. L.	Saxifragaceae	5	4.7	.4	10
Dewberry	Rubus pubescens Raf.	Rosaceae	46	43.4	8.0	55
Labrador tea	Ledum groenlandicum Oeder.	Ericaceae	1	.9	.0	5
Late sweet blueberry	Vaccinium angustifolium Ait.	Ericaceae	65	61.3	17.0	100
Pipsissewa	Chimaphila umbellata (L.) Bart.	Ericaceae	19	17.9	1.2	15
Prickly rose	Rosa acicularis Lindl.	Rosaceae	27	25.5	1.9	20
Red raspberry	Rubus strigosus Michx.	Rosaceae	29	27.4	5.0	90
Thimbleberry	Rubus parviflorus Nutt.	Rosaceae	4	3.8	.8	35
Velvet-leaf blueberry	Vaccinium myrtilloides Michx.	Ericaceae	45	42.5	5.6	65
Wintergreen	Gaultheria procumbens L.	Ericaceae	28	26.4	9.0	90
HERBS						
American vetch	Vicia americana Muhl.	Fabaceae	5	4.7	.3	10
American pyrola	Pyrola rotundifolia L.	Ericaceae	6	5.7	.4	10
Barren strawberry	Waldsteinia fragarioides (Michx.) Tratt.	Rosaceae	4	3.8	.2	5
Bishop's cap	Mitella nuda L.	Saxifragaceae	17	16.0	3.2	55
Bristly sarsaparilla	Aralia hispida Vent.	Araliaceae	1	.9	.1	10
Bunchberry	Cornus canadensis L.	Cornaceae	89	84.0	28.1	95
Clinton's lily	Clintonia borealis (Ait.) Raf.	Liliaceae	71	67.0	18.9	100
Common twisted-stalk	Streptopus roseus Michx.	Liliaceae	46	43.4	6.3	55
Cow-wheat	Melampyrum lineare Desr.	Scrophulariaceae	25	23.6	2.8	65
Creambells	Uvularia sessilifolia L.	Liliaceae	2	1.9	.1	10
Creeping lattice-leaf	Goodyera repens (L.) R. BR.	Orchidaceae	14	13.2	.8	10
Early sweet pea	Lathyrus ochroleucus Hook.	Fabaceae	13	12.3	.7	10
False lily-of-the-valley	Maianthemum canadense Desf.	Liliaceae	98	92.5	48.4	95
Fireweed	Epilobium angustifolium L.	Onagraceae	4	3.8	.2	5
Fringed bindweed	Polygonum cilinode Michx.	Polygonaceae	4	3.8	1.2	60
Fringed milkwort	Polygala paucifolia Willd.	Polygalaceae	1	.9	.1	5
Goldenrod	Solidago spp. L.	Compositae	1	.9	.1	5
Goldthread	Coptis groenlandica (Oeder) Fern.	Ranunculaceae	28	26.4	3.9	55
Grasses		Gramineae	80	75.5	22.4	95
Grape-leaved colts-foot	Petasites vitifolius Rydb.	Compositae	8	7.5	.7	15
Greater lattice-leaf	Goodyera tesselata Lodd.	Orchidaceae	3	2.8	.2	15
Hepatica	Hepatica americana (DC) Ker.	Ranunculaceae	1	.9	.1	15
Indian-pipe	Monotropa uniflora L.	Ericaceae	1	.9	.1	5
Large-leaf northern aster	Aster macrophyllus L.	Compositae	93	87.7	44.1	100
Meadow strawberry	Fragaria virginiana Duchesne.	Rosaceae	3	2.8	.2	8
Northern bedstraw	Galium boreale L.	Rubiaceae	1	.9	.1	5
Northern enchanter's nightshade	Circaea alpina L.	Onagraceae	3	2.8	.3	15
Northern hound's tongue	Cynoglossum boreale Fern.	Boraginaceae	1	.9	.1	5
Northern lungwort	Mertensia paniculata (Ait.) G. Don.	Boraginaceae	1	.9	.1	15
One-flowered pyrola	Moneses uniflora (L.) Gray	Ericaceae	4	3.8	.2	10
One-sided pyrola	Pyrola secunda L.	Ericaceae	21	19.8	2.5	30
Pearly everlasting	Anaphalis margaritacea (L.) Benth. & Hook	Compositae	1	.9	.1	5
Pink corydalis	Corydalis sempervirens (L.) Pers.	Fumariaceae	3	2.8	.1	5
Pink shinleaf	Pyrola asarifolia Michx.	Ericaceae	1	.9	.1	10
Pussy's toes	Antennaria spp. Gaertn.	Compositae	2	1.9	.3	30
Rough hawkweed	Hieracium scabrum Michx.	Compositae	1	.9	.1	10
Round-leaved rein-orchid	Habenaria orbiculata (Pursh) Torr.	Orchidaceae	4	3.8	.2	5
Red baneberry	Actaea rubra (Ait.) Willd.	Ranunculaceae	1	.9	.1	5
Sedges		Cyperaceae	33	31.1	3.8	75
Shinleaf	Pyrola virens Schweigg.	Ericaceae	8	7.5	.5	10
Spreading dogbane	Apocynum androsaemifolium L.	Apocynaceae	8	7.5	.5	10
Star-flower	Trientalis borealis Raf.	Primulaceae	71	67.0	12.1	65
Sweet bedstraw	Galium triflorum Michx.	Rubiaceae	32	30.2	3.2	55
Touch-me-not	Impatiens capensis Meerb.	Balsaminaceae	5	4.7	.5	25
Trailing arbutus	Epigaea repens L.	Ericaceae	3	2.8	.1	5
Twin-flower	Linnaea borealis L.	Caprifoliaceae	64	60.4	13.6	60
Upland strawberry	Fragaria vesca L.	Rosaceae	30	28.3	4.7	65
Violet	Viola spp. L.	Violaceae	50	47.2	6.6	60
Virgin's bower	Clematis virginiana L.	Ranunculaceae	2	1.9	.1	5
Wake-robin	Trillium grandiflorum (Michx.) Salisb.	Liliaceae	1	.9	.1	5
White cinquefoil	Potentilla tridentata Soland.	Rosaceae	1	.9	.1	5
White-flowered shinleaf	Pyrola elliptica Nutt.	Ericaceae	7	6.6	.4	10
White wood-sorrel	Oxalis montana Raf. (Small)	Oxalidaceae	1	.9	.1	10
Wild ginger	Asarum canadense L.	Aristolochiaceae	1	.9	.1	15
Wild lettuce	Lactuca canadensis L.	Compositae	1	.9	.1	5
Wild sarsaparilla	Aralia nudicaulis L.	Araliaceae	83	78.3	18.6	75
Wood anemone	Anemone quinquefolia L.	Ranunculaceae	21	19.8	1.9	30

(Continued on next page)

Table 5 continued

Nomenclature			Presence		Frequency	
Common name	Scientific name	Family name	Number of stands	Percent of stands	Average	Maximum
FERNS AND FERN ALLIES						
Beach fern	Dryopteris Phegopteris B. & B.	Polypodiaceae	1	0,9	0.1	5
Bladder fern	Cystopteris fragilis (L.) Bernh.	Polypodiaceae	1	.9	.1	5
Bracken fern	Pteridium aquilinum (L.) Kuhn.	Polypodiaceae	38	35.8	5.9	60
Grape fern	Botrychium virginianum (L.) Sw.	Ophioglossaceae	1	.9	.1	15
Interrupted fern	Osmunda claytoniana L.	Osmundaceae	5	4.7	.3	10
Lady fern	Athyrium filix-femina (L.) Roth.	Polypodiaceae	4	3.8	.3	20
Oak fern	Gymnocarpium Dryopteris (L.) Newm.	Polypodiaceae	8	7.5	.8	35
Polypody fern	Polypodium virginianum Rydb.	Polypodiaceae	7	6.6	.4	15
Rusty woodsia fern	Woodsia ilvensis (L.) R. Br.	Polypodiaceae	1	.9	.1	5
Shield fern	Dryopteris spinulosa B. & B., Rydb., Small	Polypodiaceae	10	9.4	.8	25
Flat-stem groundpine	Lycopodium complanatum L.	Lycopodiaceae	11	10.4	.7	10
Ground pine	Lycopodium obscurum L.	Lycopodiaceae	47	44.3	7.5	55
Running clubmoss	Lycopodium clavatum L.	Lycopodiaceae	42	39.6	4.8	45
Shiny clubmoss	Lycopodium lucidulum Michx.	Lycopodiaceae	3	2.8	.2	10
Stiff clubmoss	Lycopodium annotinum L.	Lycopodiaceae	29	27.4	4.1	40
Horsetail	Equisetum spp. L.	Equisetaceae	3	2.8	.2	10
MOSSES						
Dicranum	Dicranum spp. Hedw.	Dicranaceae	67	63.2	27.2	100
Hairy-cap moss	Polytrichum spp. Hedw.	Polytrichaceae	55	51.9	7.0	75
Hylocomium	Hylocomium splendens (Hedw.) Bry. Eur.	Hypnaceae	17	16.0	2.4	40
Peat moss	Sphagnum spp. L.	Sphagnaceae	4	3.8	.3	15
Plume moss	Hypnum crista-castrensis L.	Hypnaceae	31	29.2	2.7	50
Schreber's moss	Calliergonella schreberi (Willd., Br. & Sch.) Grout	Hypnaceae	91	85.8	37.8	100
All other mosses			103	97.2	56.2	100
LICHENS						
Reindeer moss	Cladonia alpestris (L.) Rabenh.	Cladoniaceae	1	.9	.2	25
	Cladonia mitis Sandst.	Cladoniaceae	18	17.0	5.0	100
	Cladonia rangiferina Wigg.	Cladoniaceae	42	39.6	8.8	100
	Cladonia sylvatica (L.) Hoffm.	Cladoniaceae	4	3.8	.2	10
Spotted peltigera	Peltigera aphthosa (L.) Willd.	Peltigeraceae	3	2.8	2.1	80
All other lichens			67	63.2	15.2	100
GROUND COVER CHARACTERISTICS						
Bare ground			23	21.7	1.9	25
Bare rock			64	60.4	13.2	100
Dead wood (over 1 inch diameter)			103	97.2	33.2	85
Litter			106	100.0	94.5	100
Live wood (over 1 inch diameter)			53	50.0	4.3	20

Community Baseline Data

Tables 6 through 17 present stand data summarized by community. The columns across each table represent species name or ground cover characteristic, number of stands in which the species occurred, percent of stands in which the species occurred, average frequency of occurrence in the sample points or plots, average density in stems per acre, average basal area in square feet per acre for tree and tall shrub species or average percent ground cover for other species, average values in percent for relative frequency, relative density, relative dominance, and importance value, and finally, the Commonness Index. Trees are indicated by (T) following the species name, saplings by (SA), and seedlings by (SE).

Table 6. – Stand data summary for the lichen community

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Other lichens	6	100.0	93.3	--	28.1	18.3	--	28.2	23.0	9,333.3
Cladonia rangiferina	6	100.0	78.3	--	14.5	14.8	--	14.5	14.7	7,833.3
Other mosses	6	100.0	75.0	--	7.2	14.3	--	7.3	10.7	7,500.0
Cladonia mitis	6	100.0	59.2	--	8.9	11.0	--	9.0	10.0	5,916.7
Polytrichum spp.	6	100.0	33.3	--	4.5	6.0	--	4.5	5.3	3,333.3
Gramineae	6	100.0	19.2	--	1.6	59.3	--	67.3	63.3	1,920.0
Peltigera aphthosa	3	50.0	36.7	--	2.3	6.5	--	2.2	4.5	1,833.3
Vaccinium angustifolium	5	83.3	10.8	--	2.0	76.2	--	75.0	75.7	902.8
Diervilla Lonicera	3	50.0	9.2	8,375.0	1.8	21.7	32.7	32.7	29.0	458.3
Cyperaceae	3	50.0	3.3	--	.2	8.1	--	5.2	6.6	165.0
Corydalis sempervirens	3	50.0	2.5	--	.1	6.2	--	2.0	4.0	125.0
Amelanchier spp.	2	33.3	3.3	100.0	.1	6.8	2.3	2.3	3.8	111.1
Calliergonella schreberi	2	33.3	2.5	--	.1	.5	--	.2	.3	83.3
Salix spp.	1	16.7	4.2	366.7	.1	9.3	11.5	11.5	10.7	69.4
Dicranum spp.	1	16.7	3.3	--	.1	.5	--	.2	.3	55.6
Acer rubrum	1	16.7	2.5	25.0	.1	10.0	10.0	14.8	11.7	41.7
Pinus banksiana (SE)	1	16.7	2.5	33.3	.1	7.2	4.2	6.7	6.0	41.7
Rubus strigosus	1	16.7	2.5	--	.3	7.2	--	8.3	7.7	41.7
Quercus rubra (SE)	1	16.7	1.7	16.7	.1	6.7	6.7	1.8	5.0	27.8
Malanthemum canadense	1	16.7	1.7	--	.1	2.2	--	.7	1.5	27.8
Salix bebbiana	1	16.7	1.7	41.7	.1	2.5	.2	.2	.8	27.8
Populus tremuloides (SE)	1	16.7	1.7	41.7	.1	4.8	5.2	3.3	4.5	27.8
Aralia hispida	1	16.7	1.7	--	.3	5.5	--	8.0	6.8	27.8
Prunus pensylvanica	1	16.7	.8	8.3	.1	8.3	3.3	3.3	5.0	13.9
Sorbus americana (SE)	1	16.7	.8	8.3	.1	2.3	1.0	1.2	1.5	13.9
Melampyrum lineare	1	16.7	.8	--	.1	2.0	--	.5	1.3	13.9
Acer spicatum	1	16.7	.8	8.3	.1	1.3	.1	.1	.5	13.9
Streptopus roseus	1	16.7	.8	--	.1	1.2	--	1.5	1.3	13.9
Anemone quinquefolia	1	16.7	.8	--	.1	8.3	--	8.3	8.3	13.9
Betula papyrifera (SE)	1	16.7	.8	50.0	.1	2.3	6.2	5.5	4.7	13.9
Aster macrophyllus	1	16.7	.8	--	.1	2.0	--	1.7	1.8	13.9
Potentilla tridentata	1	16.7	.8	--	.1	2.2	--	1.7	1.8	13.9
Trientalis borealis	1	16.7	.8	--	.1	2.0	--	.8	1.5	13.9
Aralia nudicaulis	1	16.7	.0	--	.1	.0	--	1.3	.7	.0
Ground cover characteristic:										
Bare rock	6	100.0	94.2	--	29.7	18.5	--	29.7	23.8	9,416.7
Dead wood	3	50.0	7.5	--	.7	1.3	--	.8	1.2	375.0
Bare ground	3	50.0	5.0	--	.2	1.0	--	.2	.7	250.0
Litter	6	100.0	35.8	--	4.0	6.7	--	4.0	5.2	3,583.3

Table 7. – Stand summary data for the jack pine (oak) community

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Pinus banksiana (T)	11	100.0	97.7	314.9	82.3	67.4	80.8	83.5	77.3	9,772.7
Maianthemum canadense	11	100.0	65.5	--	3.7	33.7	--	23.7	28.9	6,545.5
Betula papyrifera (SA)	11	100.0	57.9	51.9	1.3	25.2	24.5	19.5	23.3	5,790.9
Dicranum spp.	11	100.0	56.4	--	7.9	16.1	--	8.0	12.0	5,636.4
Diervilla Lonicera	11	100.0	52.7	4,795.5	1.0	40.0	45.6	30.7	38.8	5,272.7
Vaccinium angustifolium	10	90.0	54.1	--	6.6	49.1	--	55.5	52.4	4,917.4
Calliergonella schreberi	11	100.0	49.1	--	13.8	14.2	--	14.0	14.0	4,909.1
Acer rubrum (SE)	10	90.9	49.5	9,118.2	1.9	51.2	60.7	46.0	52.6	4,504.1
Gaultheria procumbens	11	100.0	45.0	--	3.8	45.2	--	38.5	41.9	4,500.0
Pinus banksiana (SA)	11	100.0	44.5	69.3	3.9	23.3	26.7	34.7	28.3	4,454.5
Picea mariana (SA)	9	81.8	50.0	54.6	1.9	22.2	25.6	27.4	25.2	4,090.9
Aster macrophyllus	11	100.0	40.0	--	7.3	18.2	--	33.1	25.6	4,000.0
Other mosses	11	100.0	38.6	--	4.5	10.7	--	4.5	7.6	3,863.6
Amelanchier spp.	11	100.0	27.7	1,509.1	.4	19.5	12.4	12.8	14.9	2,772.7
Acer rubrum (SA)	9	81.8	26.1	21.3	.5	11.5	10.5	8.5	10.2	2,134.7
Picea mariana (T)	9	81.8	20.5	26.5	4.5	12.2	6.9	3.8	7.6	1,673.6
Gramineae	9	81.8	20.5	--	.9	9.6	--	5.4	7.4	1,673.6
Cladonia rangiferina	9	81.8	17.3	--	2.5	4.5	--	2.5	3.6	1,413.2
Other lichens	8	72.7	19.1	--	3.7	4.9	--	3.7	4.4	1,388.4
Corylus cornuta	8	72.7	18.2	2,295.5	.8	11.8	16.8	17.1	15.1	1,322.3
Polytrichum spp.	8	72.7	17.3	--	1.3	4.4	--	1.3	2.8	1,256.2
Aralia nudicaulis	10	90.9	13.2	--	1.2	8.5	--	9.2	8.7	1,198.3
Cornus canadensis	8	72.7	13.6	--	.9	5.8	--	4.5	5.1	991.7
Trientalis borealis	8	72.7	10.5	--	.3	4.5	--	1.5	2.9	760.3
Pteridium aquilinum	8	72.7	9.5	--	3.3	3.6	--	11.4	7.5	694.2
Populus tremuloides (SA)	7	63.6	10.5	5.3	.1	4.1	2.5	2.5	3.1	665.3
Alnus crispa	6	54.5	11.4	922.7	.6	7.2	9.7	13.3	10.0	619.8
Betula papyrifera (T)	7	63.6	8.6	10.2	1.4	4.4	2.6	1.3	2.9	549.6
Salix bebbiana	8	72.7	7.3	172.7	.2	6.9	3.9	11.4	7.4	528.9
Abies balsamea (SA)	8	72.7	6.8	2.8	.1	3.3	1.7	1.4	2.2	495.9
Quercus rubra (SE)	5	45.5	10.9	322.7	.3	9.7	6.5	11.3	9.0	495.9
Betula papyrifera (SE)	7	63.6	7.7	154.5	.2	7.1	4.6	6.5	6.0	491.7
Melampyrum lineare	5	45.5	10.5	--	.3	4.4	--	1.2	2.8	475.2
Cladonia mitis	6	54.5	8.6	--	1.6	2.1	--	1.5	1.9	471.1
Acer rubrum (T)	7	63.6	7.3	8.5	1.3	4.3	1.9	1.3	2.5	462.8
Quercus rubra (SA)	5	45.5	8.7	3.8	.1	4.3	2.6	1.8	2.8	396.7
Linnaea borealis	4	36.4	10.5	--	.9	4.8	--	4.7	4.7	380.2
Picea mariana (SE)	6	54.5	6.8	245.5	.9	10.5	14.4	18.8	14.5	371.9
Populus tremuloides (T)	7	63.6	5.5	5.9	1.1	3.5	1.5	1.0	2.0	347.1
Abies balsamea (SE)	4	36.4	7.3	154.5	.2	7.8	6.5	4.7	6.4	264.5
Populus tremuloides (SE)	6	54.5	4.5	95.5	.1	6.3	4.2	3.9	4.8	247.9
Clintonia borealis	5	45.5	5.0	--	.3	2.2	--	2.4	2.3	227.3
Comptonia peregrina	3	27.3	8.2	995.5	.2	5.1	5.3	4.4	4.8	223.1
Pinus strobus (SE)	4	36.4	5.5	72.7	.2	5.0	2.0	3.8	3.6	198.3
Pinus strobus (SA)	4	36.4	5.0	2.8	.1	2.0	1.4	1.3	1.7	181.8
Populus grandidentata (SA)	4	36.4	3.6	1.8	.1	1.3	1.1	1.5	1.2	132.2
Pinus resinosa (T)	2	18.2	6.4	6.1	5.5	3.3	2.0	4.9	3.4	115.7
Lycopodium obscurum	4	36.4	2.7	--	.1	1.2	--	1.0	1.1	99.2
Pinus resinosa (SA)	2	18.2	5.0	1.4	.1	1.7	1.3	.9	1.3	90.9
Vaccinium myrtilloides	3	27.3	3.2	--	.5	2.9	--	3.5	3.2	86.8
Populus grandidentata (T)	4	36.4	2.3	3.4	1.1	1.4	.7	.7	1.1	82.6
Salix spp.	2	18.2	4.1	154.5	.2	1.6	.7	2.3	1.5	74.4
Picea glauca (SA)	4	36.4	2.0	1.3	.1	1.0	.5	.1	.5	72.7
Lycopodium clavatum	4	36.4	1.8	--	.1	.8	--	.7	.7	66.1
Quercus rubra (T)	3	27.3	2.3	2.5	.4	1.3	.6	.4	.8	62.0
Lonicera canadensis	3	27.3	2.3	50.0	.1	1.6	1.0	.5	1.1	62.0
Pinus strobus (T)	2	18.2	3.2	5.6	3.9	1.4	1.5	2.9	1.9	57.9
Acer spicatum	2	18.2	2.7	159.1	.1	2.9	2.0	1.9	2.3	49.6
Abies balsamea (T)	3	27.3	1.8	1.9	.3	1.0	.4	.2	.5	49.6
Hypnum crista-castrensis	2	18.2	2.3	--	.9	.8	--	1.0	.9	41.3
Goodyera repens	3	27.3	1.4	--	.1	.6	--	.1	.3	37.2
Prunus virginiana	3	27.3	1.4	18.2	.1	1.2	.2	.2	.5	37.2
Cladonia alpestris	1	9.1	2.3	--	1.0	.9	--	1.0	1.0	20.7
Apocynum androsaemifolium	2	18.2	.9	--	.1	.4	--	.3	.4	16.5
Anemone quinquefolia	2	18.2	.9	--	.1	.4	--	.1	.2	16.5
Gaultheria hispidula	2	18.2	.9	--	.1	.7	--	.3	.5	16.5
Prunus pensylvanica	2	18.2	.9	13.6	.1	1.2	.5	.2	.5	16.5
Lycopodium complanatum	1	9.1	.9	--	.1	.5	--	.3	.5	8.3
Rosa acicularis	2	18.2	.5	--	.1	.2	--	.3	.3	8.3
Picea glauca (SE)	1	9.1	.9	22.7	.2	.9	.5	4.6	2.0	8.3
Thuja occidentalis (SA)	1	9.1	.9	.6	.1	.3	.2	.5	.4	8.3
Juniperus communis	1	9.1	.5	40.9	.1	.6	1.5	4.9	2.4	4.1
Spiraea spp.	1	9.1	.5	122.7	.1	.3	.6	.5	.5	4.1
Sorbus americana (SE)	1	9.1	.5	4.5	.1	.9	.5	.4	.6	4.1
Pinus banksiana (SE)	1	9.1	.5	4.5	.1	.5	.2	.2	.3	4.1
Epigaea repens	1	9.1	.5	--	.1	.2	--	.2	.2	4.1
Hylocomium splendens	1	9.1	.5	--	.1	.1	--	.1	.1	4.1
Lycopodium annotinum	1	9.1	.5	--	.1	.3	--	.3	.3	4.1
Fragaria vesca	1	9.1	.5	--	.1	.2	--	.2	.2	4.1
Chimaphila umbellata	1	9.1	.5	--	.1	.4	--	.9	.6	4.1
Dryopteris spinulosa	1	9.1	.5	--	.1	.2	--	.2	.2	4.1
Ground cover characteristic:										
Litter	11	100.0	90.5	--	55.8	25.7	--	55.9	40.9	9,045.5
Dead wood	11	100.0	29.5	--	3.0	8.5	--	3.0	5.5	2,954.5
Bare rock	10	90.9	19.5	--	2.8	5.2	--	2.6	4.1	1,776.9
Live wood	6	54.5	4.1	--	.5	1.0	--	.5	.8	223.1
Bare ground	4	36.4	1.8	--	.1	.5	--	.1	.4	66.1

Table 8. – Stand data summary for the jack pine (fir) community

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Pinus banksiana (T)	7	100.0	94.3	303.3	90.3	52.6	64.3	71.4	62.7	9,428.6
Abies balsamea (SA)	7	100.0	72.1	97.1	3.5	33.0	35.7	37.0	35.3	7,214.3
Diervilla Lonicera	7	100.0	68.6	6,014.3	1.3	40.0	39.7	29.1	36.3	6,857.1
Aster macrophyllus	7	100.0	67.9	--	13.8	18.6	--	43.7	31.1	6,785.7
Maianthemum canadense	7	100.0	63.6	--	2.1	17.9	--	7.6	12.7	6,357.1
Other mosses	7	100.0	57.1	--	5.7	19.0	--	6.0	12.3	5,714.3
Cornus canadensis	7	100.0	55.7	--	5.2	14.0	--	13.1	13.3	5,571.4
Picea mariana (SA)	7	100.0	51.4	148.0	4.5	22.0	23.9	24.1	23.3	5,142.9
Betula papyrifera (SA)	7	100.0	50.0	62.9	1.3	21.6	22.3	16.0	20.0	5,000.0
Calliergonella schreberi	7	100.0	43.6	--	9.5	14.7	--	9.6	12.1	4,357.1
Abies balsamea (SE)	7	100.0	39.3	1,378.6	2.1	44.0	49.7	49.7	47.9	3,928.6
Linnaea borealis	7	100.0	34.3	--	1.8	10.4	--	7.4	9.1	3,428.6
Abies balsamea (T)	7	100.0	31.4	39.9	7.0	14.4	10.3	4.9	9.7	3,142.9
Corylus cornuta	5	71.4	40.7	5,500.0	2.8	18.4	28.4	34.7	27.1	2,908.2
Picea mariana (T)	6	85.7	28.6	57.4	10.4	14.1	12.0	7.6	11.0	2,449.0
Gramineae	5	71.4	26.4	--	.7	6.4	--	1.7	4.0	1,887.8
Vaccinium angustifolium	6	85.7	20.7	--	1.1	35.7	--	37.3	36.6	1,775.5
Clintonia borealis	5	71.4	24.3	--	2.2	5.3	--	4.9	5.1	1,734.7
Acer spicatum	5	71.4	22.9	2,100.0	1.3	12.9	14.4	14.6	14.0	1,632.7
Populus tremuloides (SE)	6	85.7	16.4	300.0	.3	19.0	16.3	13.9	16.3	1,408.2
Dicranum spp.	5	71.4	19.3	--	2.4	6.3	--	2.4	4.3	1,377.6
Amelanchier spp.	5	71.4	18.6	478.6	.2	8.0	2.4	2.3	4.3	1,326.5
Populus tremuloides (T)	5	71.4	17.9	28.6	16.7	8.9	6.7	12.1	9.4	1,275.5
Populus tremuloides (SA)	7	100.0	11.4	11.3	.5	5.3	3.4	4.0	4.7	1,142.9
Pinus banksiana (SA)	4	57.1	19.3	28.6	1.7	8.9	9.1	13.3	10.4	1,102.0
Aralia nudicaulis	7	100.0	10.7	--	1.7	3.3	--	5.4	4.4	1,071.4
Betula papyrifera (T)	5	71.4	14.3	13.3	3.2	6.7	3.6	2.4	4.1	1,020.4
Trientalis borealis	5	71.4	14.3	--	.4	3.4	--	1.0	2.3	1,020.4
Lonicera canadensis	5	71.4	13.6	564.3	.1	7.9	4.9	3.7	5.4	969.4
Alnus crispa	4	57.1	16.4	1,278.6	1.0	8.1	7.6	13.9	10.0	938.8
Rubus pubescens	4	57.1	15.7	--	.8	20.9	--	20.3	20.7	898.0
Vaccinium myrtilloides	6	85.7	10.0	--	.5	15.4	--	13.4	14.7	857.1
Lycopodium clavatum	5	71.4	11.4	--	.6	2.4	--	1.3	1.9	816.3
Picea glauca (SA)	5	71.4	11.4	13.4	.3	4.7	3.0	3.3	3.7	816.3
Betula papyrifera (SE)	5	71.4	10.7	221.4	.5	10.6	10.1	12.9	11.3	765.3
Coptis groenlandica	3	42.9	17.1	--	.6	3.6	--	1.3	2.4	734.7
Acer rubrum (SE)	4	57.1	9.3	535.7	.2	9.6	13.9	7.0	10.3	530.6
Lycopodium obscurum	4	57.1	9.3	--	.9	2.1	--	2.1	2.1	530.6
Sorbus americana (SE)	4	57.1	7.9	85.7	.2	7.7	4.1	5.3	5.7	449.0
Other lichens	4	57.1	7.9	--	.4	2.4	--	.3	1.4	449.0
Picea glauca (T)	5	71.4	5.7	6.3	1.3	2.7	1.4	1.1	1.9	408.2
Cladonia rangiferina	4	57.1	7.1	--	.6	2.4	--	.6	1.6	408.2
Polytrichum spp.	4	57.1	5.7	--	.2	1.9	--	.1	1.0	326.5
Lycopodium annotinum	3	42.9	6.4	--	.7	1.4	--	1.4	1.4	275.5
Picea mariana (SE)	3	42.9	5.7	135.7	.7	4.9	4.1	9.9	6.3	244.9
Fragaria vesca	2	28.6	8.6	--	.3	3.1	--	1.1	2.1	244.9
Cornus rugosa	3	42.9	3.6	150.0	.1	2.0	.7	.6	1.0	153.1
Gaultheria procumbens	2	28.6	5.0	--	.1	5.0	--	1.4	3.3	142.9
Streptopus roseus	3	42.9	2.9	--	.1	.6	--	.3	.4	122.4
Rosa acicularis	3	42.9	2.9	--	.3	6.1	--	10.9	8.6	122.4
Cyperaceae	3	42.9	2.9	--	.1	.6	--	.1	.4	122.4

(Continued on next page)

Table 8 continued

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Chimaphila umbellata	3	42.9	2.1	--	0.1	4.1	--	0.9	2.6	91.8
Populus grandidentata	2	28.6	2.9	3.0	.1	1.6	0.9	1.0	1.1	81.6
Pteridium aquilinum	4	57.1	1.4	--	1.4	.3	--	3.4	1.9	81.6
Gaultheria hispidula	2	28.6	2.9	--	.3	3.1	--	4.9	4.0	81.6
Acer rubrum (SA)	2	28.6	2.9	1.3	.1	1.6	.7	.1	.7	81.6
Pyrola elliptica	2	28.6	2.1	--	.1	.4	--	.1	.3	61.2
Hypnum crista-castrensis	2	28.6	2.1	--	.1	.7	--	.1	.4	61.2
Viola spp.	2	28.6	2.1	--	.1	.7	--	.3	.4	61.2
Melampyrum lineare	2	28.6	1.4	--	.1	.4	--	.1	.3	40.8
Rubus strigosus	2	28.6	1.4	--	.1	8.1	--	9.3	8.7	40.8
Dryopteris spinulosa	2	28.6	1.4	--	.2	.3	--	.4	.4	40.8
Lathyrus ochroleucus	2	28.6	1.4	--	.1	.4	--	.1	.3	40.8
Sorbus americana (SA)	2	28.6	1.4	.4	.1	.6	.3	.1	.4	40.8
Pinus strobus (SA)	2	28.6	1.4	.3	.1	.6	.3	.4	.4	40.8
Galium triflorum	2	28.6	1.4	--	.1	.4	--	.1	.3	40.8
Polygala paucifolia	1	14.3	2.1	--	.1	.9	--	.4	.7	30.6
Lonicera hirsuta	1	14.3	2.1	57.1	.1	.9	.3	.1	.4	30.6
Anemone quinquefolia	1	14.3	2.1	--	.1	.6	--	.1	.3	30.6
Populus grandidentata (T)	1	14.3	1.4	1.3	.6	.6	.3	.4	.4	20.4
Thuja occidentalis (SE)	1	14.3	1.4	14.3	.1	1.1	.3	.3	.6	20.4
Equisetum spp.	2	28.6	.7	--	.1	.1	--	.1	.1	20.4
Picea glauca (SE)	1	14.3	1.4	14.3	.1	1.3	.4	.6	.7	20.4
Epigaea repens	1	14.3	.7	--	.1	.3	--	.1	.2	10.2
Sphagnum spp.	1	14.3	.7	--	.1	.3	--	.1	.2	10.2
Ledum groenlandicum	1	14.3	.7	214.3	.1	.3	.9	.3	.4	10.2
Apocynum androsaemifolium	1	14.3	.7	--	.1	.1	--	.1	.1	10.2
Salix spp.	1	14.3	.7	14.3	.1	.7	.3	.3	.4	10.2
Arctostaphylos Uva-ursi	1	14.3	.7	--	.1	.9	--	1.1	1.0	10.2
Cornus stolonifera	1	14.3	.7	14.3	.1	.3	.1	.1	.2	10.2
Woodsia ilvensis	1	14.3	.7	--	.1	.1	--	.1	.1	10.2
Salix bebbiana	1	14.3	.7	21.4	.1	.4	.1	.1	.3	10.2
Athyrium filix-femina	1	14.3	.7	--	.1	.3	--	.1	.2	10.2
Osmunda claytoniana	1	14.3	.7	--	.9	.1	--	1.7	.9	10.2
Gymnocarpium Dryopteris	1	14.3	.7	--	.1	.1	--	.1	.1	10.2
Lycopodium complanatum	1	14.3	.7	--	.1	.1	--	.1	.1	10.2
Alnus rugosa	1	14.3	.7	14.3	.1	.3	.1	.1	.2	10.2
Populus balsamifera (T)	1	14.3	.7	.6	.2	.3	.1	.1	.1	10.2
Larix laricina (SE)	1	14.3	.7	7.1	.1	.6	.3	.1	.3	10.2
Polypodium virginianum	1	14.3	.7	--	.1	.1	--	.1	.1	10.2
Cladonia mitis	1	14.3	.7	--	.1	.3	--	.1	.3	10.2
Acer rubrum (T)	1	14.3	.7	.6	.1	.3	.1	.1	.2	10.2
Pinus strobus (SE)	1	14.3	.7	7.1	.1	1.0	.6	.6	.7	10.2
Mitella nuda	1	14.3	.7	--	.1	.1	--	.1	.1	10.2
Comptonia peregrina	1	14.3	.0	--	.1	.0	--	.7	.7	.0
Ground cover characteristic:										
Litter	7	100.0	97.9	--	73.2	34.4	--	74.0	54.0	9,785.7
Dead wood	7	100.0	39.3	--	4.6	13.7	--	4.6	9.4	3,928.6
Bare rock	4	57.1	5.0	--	1.0	2.0	--	1.0	1.4	285.7
Live wood	4	57.1	4.3	--	.3	1.4	--	.3	.9	244.9
Bare ground	1	14.3	.7	--	.7	.3	--	.7	.4	10.2

Table 9. – Stand data summary for the jack pine-black spruce community

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Picea mariana (SA)	7	100.0	97.1	186.0	6.2	56.4	72.7	73.6	67.6	9,714.3
Picea mariana (T)	7	100.0	85.0	160.3	32.5	40.6	46.3	29.9	39.0	8,500.0
Calliergonella schreberi	7	100.0	80.7	--	26.7	23.9	--	26.9	25.3	8,071.4
Cornus canadensis	7	100.0	70.0	--	11.3	23.6	--	31.4	27.4	7,000.0
Maianthemum canadense	7	100.0	64.3	--	2.6	22.4	--	9.1	15.7	6,428.6
Pinus banksiana (T)	6	85.7	60.0	126.7	54.4	27.6	32.1	42.7	34.1	5,142.9
Dicranum spp.	6	85.7	55.0	--	6.3	15.4	--	6.4	10.9	4,714.3
Vaccinium angustifolium	7	100.0	45.0	--	4.0	51.1	--	57.4	54.3	4,500.0
Aster macrophyllus	7	100.0	39.3	--	7.7	12.4	--	24.7	18.6	3,928.6
Other mosses	7	100.0	37.1	--	3.4	11.0	--	3.3	7.3	3,714.3
Diervilla Lonicera	6	85.7	42.1	2,571.4	.5	40.4	41.4	35.7	39.1	3,612.2
Acer rubrum (SE)	6	85.7	35.0	3,807.1	1.6	25.3	36.1	32.4	31.3	3,000.0
Betula papyrifera (SA)	6	85.7	32.9	25.9	.8	16.3	10.3	9.6	12.0	2,816.3
Amelanchier spp.	7	100.0	24.3	707.1	.2	23.7	17.7	14.7	18.9	2,428.6
Populus tremuloides (T)	7	100.0	24.3	24.0	8.3	10.9	6.9	7.0	8.3	2,428.6
Clintonia borealis	7	100.0	19.3	--	1.6	6.1	--	4.7	5.3	1,928.6
Gaultheria procumbens	5	71.4	26.4	--	1.4	25.0	--	17.4	21.1	1,887.8
Corylus cornuta	6	85.7	19.3	1,478.6	.8	18.0	21.3	26.4	21.7	1,653.1
Abies balsamea (SA)	6	85.7	18.6	18.6	.6	9.4	5.7	5.3	6.9	1,591.8
Pteridium aquilinum	5	71.4	18.6	--	5.8	6.0	--	13.3	9.7	1,326.5
Picea mariana (SE)	5	71.4	17.9	542.9	1.2	16.9	17.0	30.9	21.7	1,275.5
Populus tremuloides (SE)	5	71.4	17.1	321.4	.2	17.6	14.1	9.7	14.0	1,224.5
Gramineae	5	71.4	15.0	--	.4	5.1	--	1.4	3.4	1,071.4
Betula papyrifera (SE)	6	85.7	12.1	307.1	.2	10.0	7.6	4.4	7.3	1,040.8
Polytrichum spp.	6	85.7	11.4	--	.5	3.1	--	.4	1.9	979.6
Linnaea borealis	5	71.4	13.6	--	1.0	4.1	--	2.3	3.3	969.4
Pinus strobus (SE)	4	57.1	16.4	314.3	.6	11.4	8.9	9.4	9.9	938.8
Betula papyrifera (T)	5	71.4	11.4	8.0	1.8	5.3	3.0	2.0	3.6	816.3
Lycopodium clavatum	5	71.4	10.0	--	.9	3.1	--	2.4	2.7	714.3
Aralia nudicaulis	5	71.4	10.0	--	1.2	3.9	--	4.1	4.0	714.3
Acer rubrum (SA)	4	57.1	10.0	3.9	.1	5.0	3.3	2.3	3.4	571.4
Other lichens	5	71.4	7.9	--	.3	2.1	--	.4	1.1	561.2
Pinus strobus (T)	3	42.9	12.9	10.0	8.7	5.7	3.7	9.0	6.1	551.0
Abies balsamea (SE)	4	57.1	7.9	242.9	.5	8.3	9.9	7.9	8.6	449.0
Trientalis borealis	4	57.1	7.1	--	.2	2.9	--	.9	1.7	408.2
Lycopodium annotinum	4	57.1	6.4	--	.6	2.4	--	2.6	2.4	367.3
Vaccinium myrtilloides	5	71.4	5.0	--	.3	7.4	--	9.3	8.3	357.1
Populus tremuloides (SA)	3	42.9	7.9	13.1	.6	3.7	2.7	3.3	3.3	336.7
Pinus resinosa (T)	2	28.6	11.4	13.4	8.1	4.3	4.0	6.3	4.9	326.5
Abies balsamea (T)	4	57.1	5.0	4.9	.7	2.4	1.3	.9	1.6	285.7
Lycopodium obscurum	4	57.1	4.3	--	.1	1.3	--	.3	.9	244.9
Sorbus americana (SE)	3	42.9	5.7	85.7	.1	4.1	2.1	2.1	2.7	244.9
Pinus strobus (SA)	3	42.9	5.7	1.7	.1	3.4	1.4	2.1	2.4	244.9
Cladonia rangiferina	4	57.1	3.6	--	.1	1.0	--	.1	.7	204.1
Cyperaceae	3	42.9	3.6	--	.1	1.0	--	.1	.7	153.1
Hypnum crista-castrensis	3	42.9	2.9	--	.3	.9	--	.3	.6	122.4
Picea glauca (SA)	2	28.6	4.3	1.1	.1	2.0	1.3	1.0	1.4	122.4
Quercus rubra (SE)	2	28.6	4.3	92.9	.1	4.0	3.6	2.4	3.3	122.4
Lonicera canadensis	2	28.6	3.6	92.9	.1	3.3	1.7	.7	1.9	102.0
Alnus crispa	2	28.6	3.6	278.6	.2	4.6	8.0	10.9	7.7	102.0
Viola spp.	3	42.9	2.1	--	.1	.6	--	.1	.4	91.8
Lycopodium complanatum	3	42.9	2.1	--	.3	.7	--	1.0	.7	91.8
Picea glauca (T)	3	42.9	2.1	2.1	.8	.9	.6	.9	.9	91.8
Acer spicatum	2	28.6	2.9	164.3	.1	2.4	1.3	1.3	1.7	81.6
Acer rubrum (T)	2	28.6	2.9	1.9	.7	1.3	.9	.9	1.0	81.6
Rubus pubescens	2	28.6	2.1	--	.1	5.7	--	4.0	4.9	61.2
Pinus banksiana (SA)	2	28.6	2.1	6.6	.3	1.1	.9	1.3	1.1	61.2
Melampyrum lineare	3	42.9	1.4	--	.1	.6	--	.1	.3	61.2
Rubus strigosus	1	14.3	3.6	--	.4	3.6	--	4.1	3.9	51.0
Pinus resinosa (SA)	1	14.3	3.6	.9	.1	1.6	1.0	1.6	1.4	51.0
Pyrola elliptica	2	28.6	1.4	--	.1	.4	--	.1	.3	40.8
Gaultheria hispidula	2	28.6	1.4	--	.2	1.1	--	1.1	1.1	40.8
Goodyera repens	2	28.6	1.4	--	.1	.4	--	.1	.3	40.8
Rosa acicularis	2	28.6	1.4	--	.1	2.9	--	5.4	4.1	40.8
Chimaphila umbellata	2	28.6	1.4	--	.1	3.3	--	1.0	2.1	40.8
Anemone quinquefolia	1	14.3	2.1	--	.1	.6	--	.1	.4	30.6
Salix bebbiana	1	14.3	2.1	21.4	.1	2.0	.1	.1	.9	30.6
Comptonia peregrina	1	14.3	2.1	178.6	.1	1.7	4.0	4.0	3.3	30.6
Hylocomium splendens	1	14.3	1.4	--	.1	.3	--	.1	.1	20.4
Quercus rubra (SA)	1	14.3	1.4	.4	.1	1.0	.3	.1	.4	20.4
Populus grandidentata (T)	1	14.3	1.4	.9	.6	.6	.3	.6	.6	20.4
Populus grandidentata (SE)	1	14.3	.7	21.4	.1	.4	.4	.1	.3	10.2
Coptis groenlandica	1	14.3	.7	--	.1	.1	--	.1	.1	10.2
Pinus resinosa (SE)	1	14.3	.7	7.1	.1	.4	.1	.1	.1	10.2
Lonicera hirsuta	1	14.3	.7	114.3	.1	.7	2.9	2.9	2.1	10.2
Prunus pensylvanica	1	14.3	.7	14.3	.1	1.4	.7	.7	.9	10.2
Juniperus communis	1	14.3	.7	21.4	.1	1.9	.9	2.7	1.7	10.2
Polygonum cilinode	1	14.3	.7	--	.1	.4	--	.1	.3	10.2
Polypodium virginianum	1	14.3	.7	--	.1	.4	--	.7	.6	10.2
Picea glauca (SE)	1	14.3	.7	7.1	.1	1.0	.6	.4	.6	10.2
Streptopus roseus	1	14.3	.7	--	.1	.3	--	.1	.1	10.2
Fragaria virginiana	1	14.3	.7	--	.1	.1	--	.1	.1	10.2
Waldsteinia fragarioides	1	14.3	.7	--	.1	.3	--	.1	.1	10.2
Ground cover characteristic:										
Litter	7	100.0	98.6	--	55.1	29.9	--	55.4	42.6	9,857.1
Dead wood	7	100.0	32.1	--	5.8	9.4	--	5.9	7.9	3,214.3
Bare rock	5	71.4	6.4	--	.5	1.9	--	.6	1.3	459.2
Bare ground	2	28.6	2.1	--	.3	.6	--	.3	.4	61.2
Live wood	1	14.3	.7	--	.1	.1	--	.1	.1	10.2

Table 10. – Stand data summary for the black spruce-jack pine community

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Picea mariana (SA)	10	100.0	98.5	444.3	18.0	70.7	84.8	84.5	80.2	9,850.0
Calliergonella schreberi	10	100.0	88.0	--	43.1	23.4	--	43.2	33.3	8,800.0
Picea mariana (T)	10	100.0	84.5	409.4	67.0	52.1	51.7	43.0	48.9	8,450.0
Dicranum spp.	9	90.0	73.0	--	11.5	19.0	--	11.4	15.3	6,570.0
Pinus banksiana (T)	9	90.0	67.5	315.2	78.1	37.2	41.0	50.9	43.0	6,075.0
Other mosses	9	90.0	36.5	--	2.9	9.5	--	2.8	6.4	3,285.0
Abies balsamea (SE)	8	80.0	21.5	1,395.0	.8	37.5	31.7	28.0	32.4	1,720.0
Maianthemum canadense	8	80.0	21.0	--	.7	23.0	--	12.5	17.8	1,680.0
Diervilla Lonicera	6	60.0	18.0	840.0	.2	42.3	39.4	36.7	39.5	1,080.0
Linnaea borealis	8	80.0	13.0	--	.6	19.8	--	21.7	20.8	1,040.0
Picea mariana (SE)	7	70.0	14.5	610.0	1.1	24.3	24.6	35.1	28.0	1,015.0
Hypnum crista-castrensis	8	80.0	11.5	--	1.0	3.0	--	1.0	2.1	920.0
Abies balsamea (SA)	6	60.0	13.5	22.3	.6	8.4	5.3	4.7	6.2	810.0
Betula papyrifera (SA)	6	60.0	13.5	28.3	1.0	9.2	4.6	4.3	6.0	810.0
Aster macrophyllus	7	70.0	11.5	--	1.8	11.9	--	26.6	19.3	805.0
Pinus banksiana (SA)	6	60.0	12.0	17.8	1.2	8.2	3.4	5.5	5.7	720.0
Cladonia rangiferina	8	80.0	9.0	--	.7	2.2	--	.7	1.5	720.0
Cornus canadensis	6	60.0	9.5	--	.5	10.7	--	11.9	11.3	570.0
Other lichens	5	50.0	10.0	--	.6	2.4	--	.6	1.5	500.0
Populus tremuloides (SE)	5	50.0	6.5	150.0	.1	17.5	21.5	13.2	17.4	325.0
Abies balsamea (T)	3	30.0	9.5	12.4	1.9	4.2	3.4	2.2	3.3	285.0
Aralia nudicaulis	4	40.0	6.5	--	.3	4.7	--	4.9	4.7	260.0
Hylocomium splendens	4	40.0	6.5	--	1.2	1.7	--	1.2	1.5	260.0
Betula papyrifera (T)	5	50.0	5.0	12.2	2.2	3.0	1.5	1.3	1.9	250.0
Rosa acicularis	5	50.0	4.0	--	.3	17.8	--	30.5	24.1	200.0
Gramineae	4	40.0	5.0	--	.1	3.8	--	1.4	2.6	200.0
Vaccinium angustifolium	4	40.0	4.5	--	.2	16.1	--	16.8	16.4	180.0
Populus tremuloides (T)	4	40.0	4.5	11.0	3.2	2.4	1.3	2.0	1.9	180.0
Polytrichum spp.	3	30.0	3.5	--	.1	.9	--	.1	.5	105.0
Betula papyrifera (SE)	4	40.0	2.5	60.0	.1	4.9	4.6	6.4	5.3	100.0
Amelanchier spp.	4	40.0	2.0	40.0	.1	5.2	3.2	3.1	3.8	80.0
Goodyera repens	3	30.0	2.5	--	.1	2.8	--	1.0	1.9	75.0
Clintonia borealis	3	30.0	2.0	--	.1	2.3	--	2.5	2.4	60.0
Lycopodium clavatum	3	30.0	2.0	--	.2	1.1	--	3.1	2.2	60.0
Picea glauca (SA)	2	20.0	3.0	4.4	.2	1.9	.7	.9	1.2	60.0
Viola spp.	3	30.0	1.5	--	.1	1.2	--	.3	.7	45.0
Vaccinium myrtilloides	2	20.0	1.5	--	.1	6.1	--	2.0	4.1	30.0
Gaultheria procumbens	2	20.0	1.5	--	.1	15.0	--	5.4	10.2	30.0
Anemone quinquefolia	2	20.0	1.5	--	.1	.8	--	.5	.7	30.0
Lonicera canadensis	2	20.0	1.5	90.0	.1	4.7	8.8	8.8	7.4	30.0
Corylus cornuta	2	20.0	1.5	25.0	.1	4.0	2.3	2.3	2.9	30.0
Thuja occidentalis (SE)	1	10.0	2.5	360.0	1.3	1.5	2.5	5.0	3.0	25.0
Thuja occidentalis (SA)	1	10.0	2.5	2.3	.1	1.4	.7	.4	.8	25.0
Acer rubrum (SE)	2	20.0	1.0	15.0	.1	10.3	10.1	10.1	10.2	20.0
Gaultheria hispidula	2	20.0	1.0	--	.1	12.5	--	12.0	12.3	20.0
Chimaphila umbellata	2	20.0	1.0	--	.1	6.3	--	1.8	4.1	20.0
Coptis groenlandica	2	20.0	1.0	--	.1	1.6	--	.9	1.2	20.0
Sorbus americana (SE)	2	20.0	1.0	10.0	.1	1.3	.7	.5	.8	20.0
Picea glauca (T)	2	20.0	1.0	1.3	.3	.5	.2	.2	.4	20.0
Goodyera tesselata	1	10.0	1.5	--	.1	.6	--	.1	.3	15.0
Juniperus communis	1	10.0	1.5	55.0	.1	2.7	3.3	4.6	3.6	15.0
Thuja occidentalis (T)	1	10.0	1.5	1.5	.4	.6	.5	.5	.5	15.0
Fragaria vesca	1	10.0	1.5	--	.1	.6	--	.4	.5	15.0
Rosa acicularis	1	10.0	1.0	45.0	.1	3.3	3.2	3.2	3.3	10.0
Melampyrum lineare	1	10.0	1.0	--	.1	.4	--	.1	.2	10.0
Vicia americana	1	10.0	1.0	--	.1	.4	--	.1	.2	10.0
Pyrola secunda	1	10.0	1.0	--	.1	.4	--	.2	.3	10.0
Streptopus roseus	1	10.0	1.0	--	.1	.4	--	.2	.3	10.0
Habenaria orbiculata	1	10.0	.5	--	.1	.7	--	.5	.6	5.0
Lathyrus ochroleucus	1	10.0	.5	--	.1	.3	--	.2	.2	5.0
Petasites vitifolius	1	10.0	.5	--	.1	.2	--	.1	.1	5.0
Lycopodium annotinum	1	10.0	.5	--	.1	.4	--	.1	.3	5.0
Picea glauca (SE)	1	10.0	.5	20.0	.1	2.0	4.0	1.2	2.4	5.0
Alnus crispa	1	10.0	.5	60.0	.1	5.0	8.0	9.5	7.5	5.0
Salix bebbiana	1	10.0	.5	5.0	.1	.9	.3	.2	.5	5.0
Pyrola virens	1	10.0	.5	--	.1	.4	--	.1	.3	5.0
Rubus pubescens	1	10.0	.5	--	.1	1.3	--	2.1	1.7	5.0
Lonicera hirsuta	1	10.0	.5	15.0	.1	1.7	1.6	1.6	1.6	5.0
Cyperaceae	1	10.0	.5	--	.1	.3	--	.2	.2	5.0
Ledum groenlandicum	1	10.0	.5	--	.2	2.5	--	7.1	4.8	5.0
Arctostaphylos Uva-ursi	1	10.0	.5	--	.1	1.3	--	.7	1.0	5.0
Pyrola rotundifolia	1	10.0	.5	--	.1	.6	--	.2	.4	5.0
Rubus strigosus	1	10.0	.5	--	.1	1.3	--	1.4	1.3	5.0
Pinus strobus (SE)	1	10.0	.5	5.0	.1	.7	.1	.3	.4	5.0
Trientalis borealis	1	10.0	.5	--	.1	.7	--	.3	.5	5.0
Ground cover characteristic:										
Litter	10	100.0	98.0	--	33.4	25.7	--	33.7	29.7	9,800.0
Dead wood	10	100.0	38.0	--	3.5	10.1	--	3.6	7.0	3,800.0
Live wood	5	50.0	4.5	--	.5	1.2	--	.5	.9	225.0
Bare rock	2	20.0	3.0	--	1.0	.8	--	1.0	.9	60.0
Bare ground	1	10.0	.5	--	.1	.1	--	.1	.1	5.0

Table 11. – Stand data summary for the aspen-birch community

Item	Number of stand	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Aster macrophyllus	13	100.0	80.9	--	21.7	19.2	--	41.5	30.2	8,092.3
Populus tremuloides (T)	13	100.0	78.8	102.0	41.8	41.1	50.2	54.2	48.4	7,884.6
Diervilla Lonicera	13	100.0	70.4	21,309.0	4.5	26.3	35.2	19.0	26.8	7,038.5
Corylus cornuta	13	100.0	69.4	13,383.3	7.4	26.4	31.2	36.8	31.5	6,938.5
Betula papyrifera (SA)	13	100.0	65.0	110.2	3.5	36.3	38.6	36.5	37.2	6,500.0
Populus tremuloides (SA)	13	100.0	62.3	102.2	4.3	34.3	33.5	36.9	35.0	6,230.8
Gramineae	13	100.0	58.6	--	3.0	14.0	--	5.8	9.9	5,861.5
Other mosses	12	92.3	59.2	--	6.9	25.5	--	7.0	16.2	5,467.5
Maianthemum canadense	13	100.0	51.4	--	1.8	11.6	--	3.5	7.5	5,138.5
Betula papyrifera (T)	13	100.0	44.8	39.9	8.2	24.3	20.0	12.5	18.9	4,476.9
Clintonia borealis	13	100.0	37.5	--	4.0	7.8	--	8.1	7.8	3,746.2
Aralia nudicaulis	13	100.0	37.2	--	6.9	8.5	--	13.2	11.0	3,715.4
Populus tremuloides (SE)	13	100.0	33.8	867.9	.6	39.5	40.6	35.3	38.4	3,384.6
Cornus canadensis	13	100.0	29.6	--	1.4	6.3	--	2.8	4.7	2,961.5
Acer spicatum	10	76.9	33.6	4,856.4	3.3	12.8	13.1	16.5	14.2	2,585.8
Abies balsamea (SE)	10	76.9	30.0	1,452.5	1.0	25.2	31.3	28.8	28.5	2,307.7
Amelanchier spp.	13	100.0	21.8	1,116.7	.8	8.1	2.1	3.2	4.4	2,176.9
Abies balsamea (T)	9	69.2	29.5	24.8	5.4	12.5	11.5	6.2	10.1	2,039.6
Alnus crispa	8	61.5	22.5	5,784.6	3.9	7.4	9.8	16.8	11.4	1,387.0
Pteridium aquilinum	10	76.9	17.7	--	6.0	4.3	--	10.5	7.4	1,360.9
Cornus rugosa	9	69.2	18.8	1,224.4	.6	6.3	3.4	3.2	4.4	1,304.7
Fragaria vesca	11	84.6	14.2	--	.8	3.5	--	1.7	2.5	1,204.1
Betula papyrifera (SE)	10	76.9	15.2	335.9	.3	12.4	8.8	10.5	10.5	1,171.6
Abies balsamea (SA)	6	46.2	24.6	43.2	1.4	13.1	13.6	13.2	13.3	1,136.1
Trientalis borealis	10	76.9	14.5	--	.4	3.0	--	.7	1.9	1,112.4
Rubus pubescens	9	69.2	14.6	--	.9	31.7	--	29.2	30.4	1,011.8
Streptopus roseus	9	69.2	14.6	--	1.0	2.9	--	2.1	2.5	1,011.8
Picea mariana (T)	9	69.2	14.1	8.8	3.1	6.1	4.7	3.7	5.0	974.6
Lonicera canadensis	10	76.9	10.8	609.0	.1	3.9	1.8	.8	2.2	828.4
Picea glauca (T)	8	61.5	12.3	6.2	3.3	5.3	3.4	5.1	4.7	757.4
Calliergonella schreberi	9	69.2	10.2	--	1.5	4.5	--	1.5	3.0	703.0
Other lichens	9	69.2	9.5	--	1.1	4.0	--	1.1	2.5	655.0
Pinus banksiana (T)	7	53.8	11.9	10.3	9.4	5.4	4.8	9.1	6.5	642.0
Linnaea borealis	8	61.5	10.4	--	.4	2.3	--	.8	1.6	639.1
Lycopodium obscurum	8	61.5	10.0	--	.6	2.0	--	1.1	1.5	615.4
Vaccinium myrtilloides	8	61.5	9.8	--	1.0	18.4	--	23.8	21.2	605.9
Galium triflorum	7	53.8	7.7	--	.3	1.8	--	.5	1.2	414.2
Vaccinium angustifolium	6	46.2	7.7	--	.5	16.5	--	11.2	13.9	355.0
Lycopodium clavatum	6	46.2	6.9	--	.6	1.2	--	1.2	1.2	319.5
Rubus strigosus	7	53.8	5.5	--	.5	14.6	--	17.6	16.0	298.2
Picea glauca (SA)	5	38.5	7.7	5.1	.2	3.5	2.8	3.1	3.2	295.9
Sorbus americana (SE)	5	38.5	6.9	156.4	.1	7.1	5.8	5.1	6.1	266.3
Pinus strobus (SA)	4	30.8	8.1	6.0	.2	3.9	2.8	2.5	3.0	248.5
Cyperaceae	5	38.5	6.0	--	.2	1.5	--	.5	1.0	230.8
Pinus strobus (T)	4	30.8	7.3	3.5	6.1	3.2	3.0	7.8	4.7	224.9
Picea mariana (SA)	5	38.5	5.5	4.0	.1	2.8	2.1	1.8	2.3	213.0
Lycopodium annotinum	4	30.8	6.8	--	.7	1.2	--	1.4	1.3	208.3
Rosa acicularis	7	53.8	3.8	--	.4	11.1	--	11.8	11.5	207.1
Viola spp.	6	46.2	4.2	--	.1	.8	--	.1	.5	195.3
Prunus pensylvanica	6	46.2	4.2	146.2	.2	1.6	.2	.7	.8	195.3
Mitella nuda	4	30.8	5.8	--	.2	1.3	--	.5	.9	177.5
Pinus strobus (SE)	3	23.1	7.3	180.8	.1	4.8	4.3	3.5	4.3	168.6
Pyrola secunda	5	38.5	4.2	--	.1	.9	--	.1	.6	162.7
Picea glauca (SE)	5	38.5	4.1	44.8	.2	4.4	2.2	7.2	4.8	156.8
Coptis groenlandica	5	38.5	3.8	--	.1	.7	--	.2	.5	147.9
Salix spp.	3	23.1	5.0	126.9	.1	1.8	.2	.2	.8	115.4
Acer rubrum (SA)	2	15.4	6.5	10.7	.3	3.7	4.8	4.9	4.5	100.6
Salix bebbiana	3	23.1	4.0	260.2	.5	1.3	.5	1.4	1.2	92.3
Lonicera hirsuta	3	23.1	3.8	307.7	.1	1.6	.8	.4	1.0	88.8
Polytrichum spp.	3	23.1	3.2	--	.2	1.2	--	.2	.6	74.6
Picea mariana (SE)	3	23.1	3.1	57.7	.2	2.8	1.6	4.1	2.8	71.0
Acer rubrum (SE)	2	15.4	4.6	188.5	.1	3.7	5.2	2.5	3.8	71.0
Dicranum spp.	4	30.8	2.2	--	.1	.8	--	.1	.5	66.3
Anemone quinquefolia	3	23.1	2.7	--	.1	.5	--	.1	.3	62.1
Melampyrum lineare	4	30.8	1.5	--	.1	.3	--	.1	.2	47.3
Prunus virginiana	4	30.8	1.5	50.0	.1	.5	.1	.3	.4	47.3
Cladonia rangiferina	3	23.1	1.9	--	.1	.7	--	.1	.4	44.4
Ribes spp.	3	23.1	1.8	--	.1	4.3	--	3.4	3.8	40.8
Thuja occidentalis (T)	2	15.4	2.3	.9	.2	.9	.5	.2	.5	35.5
Lathyrus ochroleucus	3	23.1	1.4	--	.1	.3	--	.1	.3	32.0
Viburnum rafinesquianum	2	15.4	1.9	188.5	.1	.6	.8	.4	.6	29.6
Cornus stolonifera	2	15.4	1.9	200.0	.1	.7	.2	.3	.4	29.6
Pinus resinosa (T)	3	23.1	1.2	.5	1.6	.5	.2	1.3	.7	26.6
Epilobium angustifolium	3	23.1	1.2	--	.1	.3	--	.2	.2	26.6
Petasites vitifolius	2	15.4	1.5	--	.1	.3	--	.2	.2	23.7
Osmunda claytoniana	2	15.4	1.2	--	.8	.2	--	1.4	.8	17.8
Populus grandidentata (T)	2	15.4	1.2	.5	.2	.4	.2	.2	.3	17.8
Populus grandidentata (SA)	2	15.4	1.2	1.2	.1	.6	.4	.5	.5	17.8
Pinus banksiana (SA)	2	15.4	1.2	.5	.1	.5	.2	.2	.3	17.8
Apocynum androsaemifolium	2	15.4	1.2	--	.2	.3	--	.5	.3	17.8
Chimaphila umbellata	2	15.4	.8	--	.1	2.2	--	.5	1.3	11.8
Sorbus americana (SA)	2	15.4	.8	.7	.1	.5	.2	.2	.3	11.8
Acer rubrum (T)	1	7.7	1.5	.9	.1	.6	.5	.2	.5	11.8
Hypnum crista-castrensis	2	15.4	.8	--	.2	.4	--	.2	.3	11.8
Asarum canadense	1	7.7	1.2	--	.1	.2	--	.2	.2	8.9
Hepatica americana	1	7.7	1.2	--	.1	.3	--	.1	.2	8.9
Polypodium virginianum	1	7.7	1.2	--	.2	.2	--	.3	.3	8.9
Lonicera villosa	1	7.7	1.2	19.2	.1	.3	.1	.1	.2	8.9

(Continued on next page)

Table 11 continued

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Arctostaphylos Uva-ursi	1	7.7	0.8	--	0.1	1.2	--	2.3	1.8	5.9
Pyrola virens	1	7.7	.8	--	.1	.2	--	.1	.1	5.9
Hieracium scabrum	1	7.7	.8	--	.1	.2	--	.1	.2	5.9
Vicia americana	1	7.7	.8	--	.1	.2	--	.1	.2	5.9
Dryopteris spinulosa	2	15.4	.4	--	.1	.1	--	.2	.1	5.9
Pyrola rotundifolia	1	7.7	.8	--	.1	.2	--	.1	.1	5.9
Fraxinus nigra (SA)	1	7.7	.8	0.2	.1	.4	0.2	.1	.2	5.9
Cladonia mitis	1	7.7	.8	--	.1	.2	--	.1	.1	5.9
Ribes triste	1	7.7	.8	92.3	.1	.2	.2	.1	.2	5.9
Fragaria virginiana	1	7.7	.6	--	.1	.2	--	.1	.1	4.7
Antennaria spp.	1	7.7	.4	--	.1	.1	--	.1	.1	3.0
Fraxinus nigra (SE)	1	7.7	.4	3.8	.1	.2	.1	2.7	1.0	3.0
Waldsteinia fragarioides	1	7.7	.4	--	.1	.1	--	.1	.1	3.0
Circaea alpina	1	7.7	.4	--	.1	.1	--	.1	.1	3.0
Trillium grandiflorum	1	7.7	.4	--	.1	.1	--	.1	.1	3.0
Pyrola elliptica	1	7.7	.4	--	.1	.1	--	.1	.1	3.0
Anaphalis margaritacea	1	7.7	.4	--	.1	.1	--	.1	.1	3.0
Cladonia sylvatica	1	7.7	.4	--	.1	.2	--	.1	.1	3.0
Populus balsamifera (SA)	1	7.7	.4	.3	.1	.2	.1	.2	.2	3.0
Habenaria orbiculata	1	7.7	.4	--	.1	.1	--	.1	.1	3.0
Goodyera repens	1	7.7	.4	--	.1	.1	--	.1	.1	3.0
Lycopodium complanatum	1	7.7	.4	--	.1	.1	--	.1	.1	3.0
Moneses uniflora	1	7.7	.4	--	.1	.1	--	.1	.1	3.0
Lactuca canadensis	1	7.7	.4	--	.1	.1	--	.1	.1	3.0
Ground cover characteristic:										
Litter	13	100.0	99.6	--	85.0	43.6	--	85.2	64.3	9,961.5
Dead wood	13	100.0	26.8	--	2.3	11.5	--	2.3	6.9	2,676.9
Bare rock	9	69.2	9.8	--	1.8	4.0	--	1.8	2.8	681.7
Live wood	7	53.8	4.5	--	.1	1.8	--	.1	1.0	240.2
Bare ground	3	23.1	3.2	--	.3	1.5	--	.3	.9	74.6

Table 12. – Stand data summary for the maple-aspen-birch community

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Acer rubrum (SE)	15	100.0	87.7	19,806.7	4.6	44.3	80.1	52.5	59.0	8,766.7
Maianthemum canadense	15	100.0	67.3	--	2.7	19.3	--	8.2	13.7	6,733.3
Populus tremuloides (T)	15	100.0	66.3	123.3	56.3	30.1	34.5	43.6	36.2	6,633.3
Other mosses	15	100.0	60.0	--	6.6	24.2	--	6.7	15.5	6,000.0
Aster macrophyllus	15	100.0	59.7	--	14.9	16.8	--	38.4	27.5	5,966.7
Corylus cornuta	15	100.0	56.7	7,613.3	3.9	34.2	46.9	45.9	42.3	5,666.7
Acer rubrum (SA)	15	100.0	55.3	90.2	2.7	25.3	23.9	22.6	24.0	5,533.3
Betula papyrifera (SA)	15	100.0	55.3	111.9	3.6	25.5	27.3	27.9	27.1	5,533.3
Acer rubrum (T)	14	93.3	50.0	55.8	13.8	21.1	21.6	13.4	18.7	4,666.7
Betula papyrifera (T)	15	100.0	44.7	53.9	12.1	20.6	20.3	16.1	19.2	4,466.7
Clintonia borealis	15	100.0	37.3	--	4.0	10.7	--	10.9	10.7	3,733.3
Acer spicatum	12	80.0	46.3	3,766.7	2.3	27.7	29.6	33.1	30.1	3,706.7
Abies balsamea (SE)	14	93.3	39.3	1,556.7	1.8	18.5	9.8	19.9	15.9	3,671.1
Abies balsamea (SA)	11	73.3	46.0	111.4	3.6	21.9	26.5	25.9	24.9	3,373.3
Populus tremuloides (SE)	14	93.3	30.0	693.3	.7	13.5	4.1	8.9	8.7	2,800.0
Populus tremuloides (SA)	13	86.7	30.7	44.7	2.0	14.3	11.8	14.7	13.6	2,657.8
Aralia nudicaulis	15	100.0	24.3	--	4.0	6.8	--	10.1	8.5	2,433.3
Trientalis borealis	15	100.0	23.7	--	.7	6.8	--	2.3	4.5	2,366.7
Lycopodium obscurum	13	86.7	23.7	--	1.4	6.2	--	3.9	5.1	2,051.1
Cornus canadensis	14	93.3	21.7	--	1.3	6.3	--	4.2	5.2	2,022.2
Abies balsamea (T)	11	73.3	24.3	26.0	4.1	10.0	8.3	3.0	7.1	1,784.4
Diervilla Lonicera	10	66.7	23.7	1,206.7	.3	10.7	7.6	4.6	7.7	1,577.8
Gramineae	14	93.3	15.3	--	.5	4.1	--	1.3	2.7	1,431.1
Amelanchier spp.	13	86.7	15.3	683.3	.4	9.0	3.7	4.8	5.8	1,328.9
Calliergonella schreberi	13	86.7	15.0	--	2.0	5.7	--	2.1	3.9	1,300.0
Vaccinium angustifolium	12	80.0	15.0	--	1.0	43.5	--	43.1	43.3	1,200.0
Streptopus roseus	12	80.0	13.3	--	.6	3.3	--	1.6	2.5	1,066.7
Picea mariana (T)	8	53.3	18.0	17.7	4.5	7.3	6.3	4.0	5.9	960.0
Picea mariana (SA)	10	66.7	13.3	21.3	.6	5.6	4.9	5.3	5.4	888.9
Betula papyrifera (SE)	11	73.3	11.7	263.3	.3	4.9	1.5	5.7	3.9	855.6
Rubus pubescens	10	66.7	12.3	--	.8	30.2	--	28.3	29.2	822.2
Dicranum spp.	9	60.0	12.7	--	1.3	4.9	--	1.3	3.0	760.0
Viola spp.	12	80.0	9.0	--	.2	2.5	--	.7	1.7	720.0
Cornus rugosa	8	53.3	11.3	660.0	.2	5.3	3.3	2.5	3.7	604.4
Pinus strobus (SE)	9	60.0	9.3	113.3	.1	3.7	.6	1.7	2.0	560.0
Lonicera canadensis	12	80.0	7.0	293.3	.1	4.8	2.6	1.3	3.1	560.0
Alnus crispa	8	53.3	9.0	580.0	.5	3.9	2.5	4.1	3.6	480.0
Pinus strobus (T)	8	53.3	8.7	6.7	14.9	3.4	2.9	12.7	6.4	462.2
Lycopodium annotinum	8	53.3	8.3	--	.6	2.1	--	1.9	1.9	444.4
Picea glauca (T)	8	53.3	8.0	4.2	1.6	3.2	2.0	1.3	2.2	426.7
Sorbus americana (SE)	7	46.7	9.0	176.7	.2	4.4	1.3	2.5	2.7	420.0
Cyperaceae	7	46.7	9.0	--	.4	1.9	--	1.1	1.5	420.0
Pteridium aquilinum	8	53.3	7.0	--	2.8	2.1	--	6.5	4.4	373.3
Quercus rubra (SE)	4	26.7	14.0	400.0	.6	5.3	.8	4.1	3.4	373.3
Other lichens	7	46.7	7.3	--	.5	2.5	--	.5	1.5	342.2
Picea glauca (SA)	8	53.3	6.3	6.6	.2	3.0	1.7	1.6	2.3	337.8
Lycopodium clavatum	7	46.7	5.7	--	.4	1.5	--	1.5	1.6	264.4
Coptis groenlandica	7	46.7	5.3	--	.3	1.3	--	.9	1.2	248.9
Linnaea borealis	6	40.0	4.3	--	.3	1.3	--	1.1	1.3	173.3
Pinus banksiana (T)	6	40.0	4.0	3.9	2.1	1.9	1.0	2.1	1.6	160.0
Polytrichum spp.	8	53.3	3.0	--	.1	1.2	--	.1	.6	160.0
Galium triflorum	7	46.7	3.3	--	.1	1.0	--	.3	.7	155.6
Sorbus americana (SA)	6	40.0	3.7	4.0	.1	1.7	1.3	.9	1.4	146.7
Picea glauca (SE)	6	40.0	3.7	66.7	.1	1.7	.3	.9	1.0	146.7
Anemone quinquefolia	5	33.3	3.3	--	.1	.9	--	.1	.5	111.1
Vaccinium myrtilloides	6	40.0	2.7	--	.2	5.0	--	3.7	4.4	106.7
Gaultheria procumbens	4	26.7	3.7	--	.4	6.4	--	5.5	5.9	97.8
Rubus strigosus	4	26.7	3.3	--	.7	7.6	--	11.9	9.7	88.9
Quercus rubra (SA)	3	20.0	4.0	4.5	.1	1.6	1.0	.5	1.1	80.0
Picea mariana (SE)	3	20.0	3.3	80.0	.1	1.3	.9	2.2	1.5	66.7
Salix bebbiana	4	26.7	2.3	40.0	.3	1.1	.3	1.6	1.1	62.2
Viburnum rafinesquianum	3	20.0	3.0	280.0	.1	1.6	1.9	1.6	1.7	60.0
Petasites vitifolius	3	20.0	2.3	--	.1	.7	--	.3	.5	46.7
Fraxinus nigra (SE)	2	13.3	2.7	90.0	.1	1.2	.5	1.3	1.1	35.6
Populus grandidentata (T)	3	20.0	1.3	1.9	.5	.6	.5	.4	.5	26.7
Fragaria vesca	3	20.0	1.3	--	.1	.4	--	.2	.3	26.7
Dryopteris spinulosa	2	13.3	1.7	--	.2	.3	--	.5	.5	22.2
Melampyrum lineare	3	20.0	1.0	--	.1	.3	--	.1	.2	20.0
Polypodium virginianum	3	20.0	1.0	--	.1	.3	--	.1	.3	20.0
Lycopodium complanatum	3	20.0	1.0	--	.1	.4	--	.1	.3	20.0
Quercus rubra (T)	1	6.7	2.3	2.9	.6	.9	.7	.7	.8	15.6
Apocynum androsaemifolium	2	13.3	1.0	--	.2	.2	--	.3	.3	13.3
Rosa acicularis	2	13.3	1.0	--	.1	3.2	--	4.0	3.7	13.3
Osmunda claytoniana	2	13.3	1.0	--	.4	.2	--	1.1	.7	13.3
Gaultheria hispidula	2	13.3	.7	--	.1	4.0	--	3.5	3.7	8.9
Pinus strobus (SA)	2	13.3	.7	.3	.1	.3	.1	.3	.3	8.9
Athyrium filix-femina	1	6.7	1.3	--	.3	.4	--	1.1	.7	8.9
Impatiens capensis	2	13.3	.7	--	.1	.1	--	.1	.1	8.9
Fraxinus nigra (SA)	2	13.3	.7	.9	.1	.3	.2	.3	.3	8.9
Pinus resinosa (T)	1	6.7	1.3	.5	2.0	.5	.3	2.3	1.1	8.9
Gymnocarpium Dryopteris	1	6.7	1.0	--	.1	.2	--	.1	.1	6.7
Uvularia sessilifolia	1	6.7	.7	--	.1	.1	--	.1	.1	4.4
Sorbus americana (T)	1	6.7	.7	.3	.1	.3	.1	.1	.2	4.4
Populus grandidentata (SE)	1	6.7	.7	6.7	.1	.3	.1	.2	.2	4.4
Thuja occidentalis (SE)	1	6.7	.7	6.7	.1	.3	.1	.1	.1	4.4
Pyrola secunda	1	6.7	.7	--	.1	.3	--	.1	.2	4.4
Prunus virginiana	1	6.7	.7	6.7	.1	.7	.1	.3	.3	4.4
Pyrola rotundifolia	1	6.7	.3	--	.1	.1	--	.1	.1	2.2

(Continued on next page)

Table 12 continued

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Monotropa uniflora	1	6.7	0.3	--	0.1	0.1	--	0.1	0.1	2.2
Populus grandidentata (SA)	1	6.7	.3	0.2	.1	.1	0.1	.1	.1	2.2
Cladonia rangiferina	1	6.7	.3	--	.1	.1	--	.1	.1	2.2
Dryopteris Phegopteris	1	6.7	.3	--	.1	.1	--	.2	.1	2.2
Lathyrus ochroleucus	1	6.7	.3	--	.1	.1	--	.1	.1	2.2
Thuja occidentalis (T)	1	6.7	.3	.1	.1	.1	.1	.1	.1	2.2
Hypnum crista-castrensis	1	6.7	.3	--	.1	.1	--	.1	.1	2.2
Sphagnum spp.	1	6.7	.3	--	.1	.1	--	.1	.1	2.2
Epilobium angustifolium	1	6.7	.3	--	.1	.1	--	.1	.1	2.2
Mitella nuda	1	6.7	.3	--	.1	.1	--	.1	.1	2.2
Equisetum spp.	1	6.7	.3	--	.1	.1	--	.1	.1	2.2
Solidago spp.	1	6.7	.3	--	.1	.1	--	.1	.1	2.2
Alnus rugosa	1	6.7	.3	13.3	.1	.3	.1	.1	.2	2.2
Tilia americana (SE)	1	6.7	.3	3.3	.1	.2	.1	.1	.1	2.2
Fraxinus nigra (T)	1	6.7	.3	.4	.1	.2	.1	.1	.1	2.2
Polygonum cilinode	1	6.7	.0	--	.1	.0	--	.1	.1	.0
Ground cover characteristic:										
Litter	15	100.0	99.3	--	83.4	40.4	--	83.9	62.1	9,933.3
Dead wood	15	100.0	37.3	--	4.2	15.0	--	4.3	9.6	3,733.3
Bare rock	9	60.0	7.0	--	.7	2.6	--	.8	1.6	420.0
Live wood	9	60.0	5.3	--	.3	2.1	--	.4	1.2	320.0
Bare ground	4	26.7	2.7	--	.1	1.1	--	.1	.6	71.1

Table 13. – Stand data summary for the white pine community

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Pinus strobus (T)	6	100.0	90.0	188.5	125.0	44.2	56.5	71.7	57.7	9,000.0
Diervilla Lonicera	6	100.0	77.5	12,525.0	2.6	43.8	59.2	44.0	49.2	7,750.0
Aster macrophyllus	6	100.0	72.5	--	20.6	22.8	--	58.3	40.7	7,250.0
Maianthemum canadense	6	100.0	61.7	--	1.9	19.7	--	7.2	13.7	6,166.7
Abies balsamea (SE)	6	100.0	53.3	15,333.3	1.3	38.5	57.2	45.2	47.0	5,333.3
Abies balsamea (T)	6	100.0	41.7	91.0	11.7	20.0	19.3	8.0	16.0	4,166.7
Gramineae	6	100.0	40.8	--	1.4	12.8	--	4.7	8.5	4,083.3
Aralia nudicaulis	6	100.0	38.3	--	4.2	12.0	--	13.8	13.0	3,833.3
Other mosses	5	83.3	45.0	--	4.8	17.8	--	4.7	11.2	3,750.0
Corylus cornuta	6	100.0	35.8	3,066.7	1.3	18.8	19.8	20.7	19.7	3,583.3
Abies balsamea (SA)	4	66.7	53.3	165.5	5.9	31.5	37.2	38.7	35.8	3,555.6
Amelanchier spp.	7	116.7	24.2	891.7	.4	14.7	6.3	10.3	11.5	2,819.4
Pinus strobus (SE)	6	100.0	26.7	2,366.7	.3	19.3	12.8	11.0	14.2	2,666.7
Pinus resinosa (T)	5	83.3	24.2	24.3	15.9	11.7	8.3	10.0	10.2	2,013.9
Linnaea borealis	5	83.3	21.7	--	.7	6.5	--	2.3	4.5	1,805.6
Acer spicatum	5	83.3	20.0	1,583.3	1.8	9.8	6.3	18.8	15.7	1,666.7
Cornus canadensis	5	83.3	17.5	--	1.0	5.5	--	4.7	5.0	1,458.3
Betula papyrifera (T)	6	100.0	14.2	15.8	3.5	6.8	4.7	1.8	4.5	1,416.7
Betula papyrifera (SA)	4	66.7	20.8	18.5	.4	10.8	8.8	6.8	8.8	1,388.9
Calliergonella schreberi	4	66.7	19.2	--	4.2	7.7	--	4.5	5.8	1,277.8
Vaccinium myrtilloides	4	66.7	15.0	--	1.6	24.3	--	35.5	30.0	1,000.0
Populus tremuloides (SE)	5	83.3	11.7	308.3	.3	8.5	4.3	8.0	7.0	972.2
Populus tremuloides (T)	5	83.3	10.8	10.0	6.0	4.8	3.0	3.3	3.8	902.8
Pinus strobus (SA)	3	50.0	15.8	7.7	.4	7.5	5.8	8.3	7.2	791.7
Lonicera canadensis	5	83.3	9.2	375.0	.1	5.2	2.8	1.5	3.2	763.9
Picea glauca (T)	6	100.0	7.5	6.3	2.1	3.7	1.5	1.2	2.3	750.0
Cornus rugosa	3	50.0	15.0	816.7	.5	6.3	4.2	5.2	5.0	750.0
Betula papyrifera (SE)	4	66.7	10.8	225.0	.1	5.8	1.7	3.7	3.8	722.2
Acer rubrum (SA)	2	33.3	17.5	17.7	.5	7.8	9.5	7.7	8.3	583.3
Acer rubrum (SE)	2	33.3	17.5	1,475.0	.5	12.5	16.8	16.7	15.3	583.3
Pinus banksiana (T)	5	83.3	6.7	5.7	3.7	3.2	1.3	2.2	2.2	555.6
Vaccinium angustifolium	4	66.7	8.3	--	.3	22.2	--	15.3	18.8	555.6
Picea glauca (SE)	4	66.7	6.7	75.0	.2	7.2	3.7	9.5	6.5	444.4
Sorbus americana (SE)	3	50.0	8.3	116.7	.1	6.3	3.7	4.5	4.8	416.7
Dicranum spp.	3	50.0	8.3	--	.6	2.8	--	.7	1.7	416.7
Other lichens	3	50.0	8.3	--	.8	3.0	--	.7	1.7	416.7
Clintonia borealis	3	50.0	8.3	--	.4	2.7	--	2.2	2.3	416.7
Populus tremuloides (SA)	3	50.0	7.5	16.7	.6	4.2	2.5	2.5	3.0	375.0
Anemone quinquefolia	3	50.0	6.7	--	.2	2.3	--	.5	1.3	333.3
Acer rubrum (T)	2	33.3	10.0	9.0	1.7	4.3	2.8	.8	2.8	333.3
Pteridium aquilinum	4	66.7	5.0	--	.5	1.7	--	1.7	1.5	333.3
Alnus crispa	3	50.0	5.8	441.7	.3	2.5	1.3	3.2	3.3	291.7
Trientalis borealis	2	33.3	8.3	--	.2	3.0	--	1.0	1.8	277.8
Rosa acicularis	4	66.7	4.2	--	.3	24.5	--	28.0	26.2	277.8
Fragaria vesca	2	33.3	7.5	--	.2	2.2	--	.5	1.3	250.0
Lycopodium obscurum	3	50.0	3.3	--	.2	1.2	--	.8	1.0	166.7
Rubus pubescens	2	33.3	4.2	--	.1	13.0	--	5.8	9.5	138.9
Picea glauca (SA)	3	50.0	2.5	2.7	.1	1.5	.5	1.0	1.0	125.0
Picea mariana (SA)	2	33.3	3.3	7.2	.2	1.8	1.0	.7	1.2	111.1
Streptopus roseus	2	33.3	3.3	--	.1	1.2	--	.3	.8	111.1
Antennaria spp.	1	16.7	5.0	--	.1	1.7	--	.3	1.0	83.3
Picea mariana (T)	2	33.3	2.5	4.7	1.4	1.2	.8	.8	1.0	83.3
Melampyrum lineare	2	33.3	2.5	--	.1	.8	--	.2	.5	83.3
Gaultheria procumbens	1	16.7	3.3	--	.1	7.3	--	7.2	7.3	55.6
Pyrola secunda	1	16.7	3.3	--	.1	1.0	--	.5	.8	55.6
Cladonia mitis	1	16.7	3.3	--	.5	1.0	--	.5	.8	55.6
Sorbus americana (SA)	2	33.3	1.7	.5	.1	1.0	.3	.5	.7	55.6
Polytrichum spp.	2	33.3	1.7	--	.1	.7	--	.2	.3	55.6
Lathyrus ochroleucus	2	33.3	1.7	--	.1	.5	--	.3	.3	55.6
Salix bebbiana	2	33.3	1.7	25.0	.1	1.0	.2	.3	.5	55.6
Cyperaceae	1	16.7	3.3	--	.1	1.0	--	.3	.7	55.6
Rubus strigosus	2	33.3	1.7	--	.1	3.7	--	2.7	3.2	55.6
Viola spp.	2	33.3	1.7	--	.1	.7	--	.1	.4	55.6
Arctostaphylos Uva-ursi	1	16.7	2.5	--	.1	2.3	--	1.2	1.8	41.7
Picea mariana (SE)	1	16.7	2.5	75.0	.1	1.3	.2	1.2	.8	41.7
Viburnum rafinesquianum	1	16.7	.8	16.7	.1	.5	.1	.1	.2	13.9
Vicia americana	1	16.7	.8	--	.1	.3	--	.1	.2	13.9
Prunus pensylvanica	1	16.7	.8	8.3	.1	.3	.1	.1	.2	13.9
Lonicera hirsuta	1	16.7	.8	58.3	.1	.5	.3	.2	.3	13.9
Clematis virginiana	1	16.7	.8	--	.1	.3	--	.2	.2	13.9
Galium triflorum	1	16.7	.8	--	.1	.3	--	.1	.2	13.9
Cladonia rangiferina	1	16.7	.8	--	.1	.3	--	.1	.2	13.9
Pinus resinosa (SE)	1	16.7	.8	8.3	.1	.3	.1	.3	.2	13.9
Thuja occidentalis (SA)	1	16.7	.8	2.2	.1	.5	.2	.3	.3	13.9
Chimaphila umbellata	1	16.7	.8	--	.1	2.8	--	1.0	1.8	13.9
Fragaria virginiana	1	16.7	.8	--	.1	.3	--	.1	.2	13.9
Pinus resinosa (SA)	1	16.7	.8	.3	.1	.3	.2	.3	.3	13.9
Coptis groenlandica	1	16.7	.8	--	.1	.3	--	.2	.2	13.9
Rubus parviflorus	1	16.7	.0	--	.1	.0	--	3.2	3.2	.0
Lycopodium clavatum	1	16.7	.0	--	.1	.0	--	.1	.1	.0
Ground cover characteristic:										
Litter	6	100.0	99.2	--	84.4	45.8	--	85.3	65.5	9,916.7
Dead wood	6	100.0	32.5	--	2.7	15.2	--	2.7	8.8	3,250.0
Live wood	4	66.7	6.7	--	.6	3.2	--	.5	1.8	444.4
Bare rock	3	50.0	7.5	--	.3	2.7	--	.2	1.7	375.0

Table 14. – Stand data summary for the red pine community

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Pinus resinosa (T)	4	100.0	78.7	156.7	146.9	37.0	38.5	48.5	41.5	7,875.0
Pinus strobus (T)	4	100.0	76.3	89.5	58.5	34.2	39.0	40.7	37.7	7,625.0
Dicranum spp.	4	100.0	55.0	--	9.1	14.5	--	9.0	11.7	5,500.0
Pinus strobus (SE)	4	100.0	51.3	3,300.0	1.9	36.7	28.2	32.5	32.5	5,125.0
Vaccinium angustifolium	4	100.0	48.8	--	7.1	41.7	--	50.2	45.7	4,875.0
Other mosses	4	100.0	47.5	--	3.0	12.5	--	3.0	7.8	4,750.0
Maianthemum canadense	4	100.0	43.8	--	1.7	45.0	--	37.5	41.3	4,375.0
Calliergonella schreberi	4	100.0	42.5	--	10.8	11.7	--	11.0	11.5	4,250.0
Other lichens	4	100.0	30.0	--	1.3	7.3	--	1.5	4.3	3,000.0
Amelanchier spp.	4	100.0	28.8	1,700.0	.4	28.0	23.5	17.5	23.0	2,875.0
Gaultheria procumbens	3	75.0	36.3	--	3.1	28.5	--	17.2	23.0	2,718.8
Acer rubrum (SE)	3	75.0	33.8	4,525.0	.8	23.5	42.7	16.5	27.5	2,531.3
Aster macrophyllus	3	75.0	31.3	--	6.4	13.8	--	29.0	21.0	2,343.8
Vaccinium myrtilloides	3	75.0	27.5	--	4.9	18.2	--	23.8	21.0	2,062.5
Pinus strobus (SA)	2	50.0	40.0	22.5	.6	14.2	17.0	17.0	16.0	2,000.0
Corylus cornuta	3	75.0	23.8	1,437.5	.5	22.5	28.8	29.7	26.7	1,781.3
Melampyrum lineare	3	75.0	21.3	--	.7	10.2	--	5.0	7.5	1,593.8
Cladonia rangiferina	4	100.0	15.0	--	2.3	4.0	--	2.3	3.3	1,500.0
Gramineae	2	50.0	26.3	--	1.2	8.8	--	3.8	6.3	1,312.5
Betula papyrifera (T)	3	75.0	16.3	19.7	2.3	7.5	5.8	.8	4.5	1,218.8
Cornus canadensis	3	75.0	15.0	--	1.6	8.5	--	14.2	11.5	1,125.0
Picea mariana (SE)	3	75.0	15.0	462.5	1.4	14.5	16.7	30.0	20.5	1,125.0
Picea mariana (SA)	2	50.0	21.3	10.2	.2	7.3	6.8	4.8	6.5	1,062.5
Cladonia mitis	3	75.0	12.5	--	1.7	3.3	--	1.8	2.5	937.5
Polytrichum spp.	4	100.0	8.8	--	.8	2.3	--	.8	1.8	875.0
Pinus resinosa (SA)	2	50.0	16.3	6.5	.3	5.8	4.5	6.3	5.5	812.5
Betula papyrifera (SA)	2	50.0	16.3	6.5	.2	5.5	4.5	5.3	5.3	812.5
Pinus banksiana (T)	2	50.0	15.0	9.8	7.1	6.0	6.0	5.3	5.8	750.0
Diervilla Lonicera	3	75.0	8.8	225.0	.1	8.5	4.0	2.5	4.8	656.3
Aralia nudicaulis	3	75.0	8.8	--	.5	3.5	--	2.3	2.8	656.3
Alnus crispa	2	50.0	11.3	750.0	.4	9.8	11.5	20.0	14.0	562.5
Betula papyrifera (SE)	3	75.0	7.5	362.5	.3	5.3	4.5	3.8	4.5	562.5
Acer rubrum (T)	2	50.0	10.0	5.0	1.8	4.3	3.0	1.5	3.0	500.0
Populus tremuloides (SE)	3	75.0	5.0	87.5	.1	4.0	1.8	1.0	2.0	375.0
Cyperaceae	3	75.0	5.0	--	.2	2.5	--	1.0	1.8	375.0
Comptonia peregrina	2	50.0	7.5	287.5	.1	7.8	6.0	3.5	5.8	375.0
Acer rubrum (SA)	1	25.0	12.5	6.0	.2	4.8	6.0	5.0	5.3	312.5
Quercus rubra (T)	2	50.0	6.3	2.8	.3	2.5	2.0	.3	1.8	312.5
Abies balsamea (SA)	1	25.0	12.5	5.0	.1	4.3	3.0	2.8	3.3	312.5
Quercus rubra (SE)	1	25.0	12.5	325.0	.3	5.5	2.0	4.3	4.0	312.5
Pinus resinosa (SE)	3	75.0	3.8	75.0	.2	3.5	2.5	6.3	4.3	281.3
Abies balsamea (T)	2	50.0	5.0	2.5	.3	2.3	1.3	.3	1.3	250.0
Picea mariana (T)	2	50.0	5.0	5.5	2.6	2.5	1.0	1.5	2.0	250.0
Thuja occidentalis (SA)	1	25.0	8.8	4.5	.2	3.0	2.8	4.3	3.3	218.8
Juniperus communis	1	25.0	7.5	487.5	.2	21.5	24.2	24.7	23.5	187.5
Sorbus americana (SE)	2	50.0	3.8	37.5	.1	2.8	.8	.8	1.5	187.5
Pinus banksiana (SA)	1	25.0	7.5	3.0	.1	2.8	2.8	2.5	2.8	187.5
Chimaphila umbellata	2	50.0	3.8	--	.1	6.5	--	1.8	4.0	187.5
Picea glauca (SE)	2	50.0	2.5	25.0	.3	2.3	.5	4.3	2.3	125.0
Picea glauca (T)	1	25.0	5.0	1.0	.3	1.8	1.3	.5	1.3	125.0
Abies balsamea (SE)	2	50.0	2.5	25.0	.1	2.3	.5	.8	1.3	125.0
Quercus rubra (SA)	1	25.0	5.0	1.3	.1	1.8	1.3	1.5	1.5	125.0
Salix bebbiana	2	50.0	2.5	100.0	.1	2.3	1.3	2.3	2.0	125.0
Thuja occidentalis (T)	1	25.0	5.0	3.0	.8	2.3	1.3	.5	1.3	125.0
Arctostaphylos Uva-ursi	1	25.0	3.8	--	1.0	4.5	--	7.3	5.8	93.8
Sphagnum spp.	1	25.0	3.8	--	.6	1.0	--	.8	.8	93.8
Pteridium aquilinum	1	25.0	2.5	--	.6	1.5	--	5.3	3.3	62.5
Picea glauca (SA)	1	25.0	2.5	.8	.1	1.0	.5	.8	.8	62.5
Streptopus roseus	1	25.0	2.5	--	.1	.8	--	.3	.5	62.5
Linnaea borealis	1	25.0	2.5	--	.1	1.8	--	.5	1.3	62.5
Clintonia borealis	1	25.0	1.3	--	.1	.8	--	.3	.5	31.3
Goodyera tesselata	1	25.0	1.3	--	.1	.8	--	.3	.5	31.3
Lycopodium clavatum	1	25.0	1.3	--	.1	.3	--	.3	.3	31.3
Anemone quinquefolia	1	25.0	1.3	--	.1	.3	--	.1	.2	31.3
Trientalis borealis	1	25.0	1.3	--	.1	.8	--	.3	.5	31.3
Hypnum crista-castrensis	1	25.0	1.3	--	.1	.3	--	.1	.2	31.3
Polypodium virginianum	1	25.0	1.3	--	.1	1.0	--	.3	.5	31.3
Ground cover characteristic:										
Litter	4	100.0	98.8	--	63.8	26.7	--	63.5	45.0	9,875.0
Bare rock	4	100.0	31.3	--	3.3	8.3	--	3.5	5.5	3,125.0
Dead wood	4	100.0	26.3	--	2.3	7.0	--	2.0	4.8	2,625.0
Live wood	2	50.0	5.0	--	1.2	1.0	--	1.3	1.3	250.0
Bare ground	1	25.0	1.3	--	.1	.3	--	.1	.2	31.3

Table 15. – Stand data summary for the budworm-damaged community

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Abies balsamea (SE)	10	100.0	76.0	3,645.0	4.5	44.5	51.5	60.8	52.3	7,600.0
Abies balsamea (SA)	10	100.0	75.5	128.2	3.2	48.3	60.4	54.5	54.5	7,550.0
Maianthemum canadense	10	100.0	59.0	--	2.5	17.1	--	8.7	12.9	5,900.0
Calliergonella schreberi	10	100.0	57.0	--	12.4	17.8	--	12.3	15.1	5,700.0
Other mosses	10	100.0	51.5	--	6.1	17.1	--	6.2	11.6	5,150.0
Cornus canadensis	9	90.0	48.0	--	5.5	12.1	--	14.5	13.1	4,320.0
Aster macrophyllus	9	90.0	46.5	--	10.3	13.1	--	30.5	21.9	4,185.0
Betula papyrifera (T)	9	90.0	44.3	59.5	12.0	19.9	20.4	15.5	18.6	3,987.0
Picea mariana (T)	8	80.0	44.3	65.2	17.6	20.4	21.6	18.8	20.3	3,544.0
Diervilla Lonicera	9	90.0	36.5	2,025.0	.4	24.2	20.4	13.9	19.3	3,285.0
Linnaea borealis	10	100.0	32.0	--	1.9	8.6	--	6.4	7.7	3,200.0
Betula papyrifera (SA)	10	100.0	31.7	40.1	1.7	21.0	19.7	23.0	21.3	3,170.0
Abies balsamea (T)	9	90.0	33.3	35.2	6.0	22.6	20.7	15.2	19.4	2,997.0
Populus tremuloides (T)	8	80.0	35.2	57.1	31.0	14.0	15.3	22.8	17.4	2,816.0
Corylus cornuta	9	90.0	30.5	3,355.0	1.6	20.9	29.9	34.5	28.3	2,745.0
Populus tremuloides (SE)	9	90.0	29.0	865.0	.5	14.7	12.5	7.9	11.6	2,610.0
Acer spicatum	9	90.0	26.5	1,425.0	.9	20.8	23.0	30.3	24.8	2,385.0
Betula papyrifera (SE)	9	90.0	25.5	1,475.0	.6	13.7	17.2	10.0	13.7	2,295.0
Gramineae	9	90.0	25.0	--	.8	6.6	--	2.7	4.6	2,250.0
Picea mariana (SA)	8	80.0	26.6	20.6	.9	17.3	11.8	15.8	15.0	2,128.0
Aralia nudicaulis	9	90.0	23.5	--	3.3	7.2	--	11.9	9.4	2,115.0
Dicranum spp.	7	70.0	29.5	--	3.2	8.4	--	3.2	5.8	2,065.0
Clintonia borealis	9	90.0	20.5	--	2.3	4.5	--	6.5	5.5	1,845.0
Lonicera canadensis	9	90.0	15.5	790.0	.2	14.9	15.5	11.5	13.9	1,395.0
Picea glauca (T)	8	80.0	16.6	10.7	5.6	6.5	4.6	6.7	6.0	1,328.0
Acer rubrum (SE)	6	60.0	22.0	1,175.0	1.1	10.7	11.6	9.5	10.6	1,320.0
Rubus strigosus	6	60.0	21.5	--	7.9	25.8	--	31.0	28.5	1,290.0
Pinus banksiana (T)	6	60.0	20.2	18.6	13.0	7.4	7.4	11.7	8.9	1,212.0
Trientalis borealis	9	90.0	13.0	--	.3	3.4	--	.6	2.2	1,170.0
Rubus pubescens	7	70.0	16.5	--	1.1	32.6	--	26.4	29.4	1,155.0
Viola spp.	8	80.0	11.5	--	.3	3.0	--	.7	2.1	920.0
Fragaria vesca	7	70.0	13.0	--	.8	3.5	--	2.6	3.2	910.0
Other lichens	7	70.0	12.5	--	.9	3.9	--	.9	2.4	875.0
Amelanchier spp.	7	70.0	10.5	215.0	.1	7.9	3.5	2.4	4.7	735.0
Lycopodium clavatum	6	60.0	10.0	--	.8	2.3	--	2.0	2.2	600.0
Pyrola secunda	6	60.0	8.5	--	.5	2.5	--	1.7	2.1	510.0
Sorbus americana (SE)	5	50.0	10.0	160.0	.2	5.1	2.1	1.8	3.1	500.0
Picea glauca (SE)	7	70.0	7.0	115.0	.1	4.3	1.6	1.9	2.6	490.0
Populus tremuloides (SA)	6	60.0	7.5	3.9	.1	6.2	4.1	2.3	4.2	450.0
Picea mariana (SE)	6	60.0	6.5	185.0	.6	3.9	2.8	6.9	4.5	390.0
Polygonum cilinode	3	30.0	12.0	--	.8	5.0	--	4.4	4.7	360.0
Galium triflorum	7	70.0	4.5	--	.2	1.5	--	.9	1.2	315.0
Vaccinium angustifolium	6	60.0	5.0	--	.3	12.6	--	13.5	13.1	300.0
Coptis groenlandica	3	30.0	7.5	--	.4	1.3	--	.8	1.1	225.0
Polytrichum spp.	6	60.0	3.5	--	.3	1.1	--	.2	.7	210.0
Picea glauca (SA)	5	50.0	4.1	1.8	.1	2.4	.9	1.4	1.8	205.0
Thuja occidentalis (T)	2	20.0	10.0	10.5	2.7	7.2	8.1	8.0	7.8	200.0
Hylocomium splendens	4	40.0	5.0	--	1.0	1.4	--	.9	1.1	200.0
Vaccinium myrtilloides	6	60.0	3.0	--	.2	9.8	--	9.8	9.7	180.0
Lycopodium obscurum	4	40.0	4.5	--	.2	.8	--	.6	.7	180.0
Streptopus roseus	4	40.0	3.5	--	.2	.8	--	.6	.7	140.0
Rosa acicularis	4	40.0	3.5	--	.2	7.5	--	6.9	7.3	140.0
Acer rubrum (SA)	3	30.0	4.5	3.6	.1	2.1	1.3	.7	1.4	135.0
Mitella nuda	3	30.0	4.5	--	.1	1.0	--	.3	.6	135.0
Acer rubrum (T)	4	40.0	3.1	2.8	.6	1.2	.7	.6	.8	124.0
Alnus crispa	3	30.0	4.0	435.0	.4	2.1	2.8	4.0	2.9	120.0
Pinus strobus (SE)	4	40.0	3.0	30.0	.1	1.5	.3	.5	.8	120.0
Chimaphila umbellata	3	30.0	3.5	--	.1	6.0	--	4.0	5.0	105.0
Lonicera hirsuta	2	20.0	4.0	75.0	.1	2.8	1.1	.7	1.5	80.0
Pyrola rotundifolia	3	30.0	2.5	--	.1	.8	--	.2	.5	75.0
Hypnum crista-castrensis	3	30.0	2.0	--	.3	.5	--	.3	.5	60.0
Lathyrus ochroleucus	3	30.0	2.0	--	.1	.5	--	.4	.4	60.0
Cyperaceae	4	40.0	1.5	--	.1	.4	--	.1	.3	60.0
Salix bebbiana	2	20.0	2.0	20.0	.1	1.1	.2	.2	.5	40.0
Cornus rugosa	2	20.0	2.0	370.0	.1	1.4	1.9	1.5	1.6	40.0
Thuja occidentalis (SA)	1	10.0	3.0	1.3	.1	1.8	.9	1.8	1.5	30.0
Pinus strobus (T)	2	20.0	1.5	2.0	.7	.6	.3	.4	.5	30.0
Lycopodium complanatum	2	20.0	1.5	--	.3	.5	--	1.6	1.0	30.0
Rubus parviflorus	1	10.0	2.5	--	.6	3.1	--	6.3	4.7	25.0
Waldsteinia fragarioides	2	20.0	1.0	--	.1	.3	--	.1	.2	20.0
Lycopodium annotinum	1	10.0	2.0	--	.3	.3	--	.6	.5	20.0
Pyrola elliptica	2	20.0	1.0	--	.1	.2	--	.1	.2	20.0
Melampyrum lineare	2	20.0	1.0	--	.1	.3	--	.1	.2	20.0
Quercus rubra (SE)	1	10.0	2.0	25.0	.1	.7	.3	.2	.4	20.0
Vicia americana	2	20.0	1.0	--	.1	.3	--	.2	.2	20.0
Thuja occidentalis (SE)	1	10.0	1.5	15.0	.1	.6	.2	.1	.3	15.0
Pyrola asarifolia	1	10.0	1.0	--	.1	.2	--	.1	.1	10.0
Prunus pensylvanica	1	10.0	1.0	20.0	.1	2.5	1.1	.3	1.3	10.0
Anemone quinquefolia	1	10.0	1.0	--	.1	.2	--	.1	.1	10.0
Cladonia rangiferina	1	10.0	1.0	--	.1	.3	--	.1	.2	10.0
Equisetum spp.	1	10.0	1.0	--	.1	.2	--	.1	.1	10.0
Ribes spp.	1	10.0	1.0	--	.3	1.0	--	.7	.8	10.0
Petasites vitifolius	1	10.0	.5	--	.1	.1	--	.1	.1	5.0
Uvularia sessilifolia	1	10.0	.5	--	.1	.1	--	.1	.1	5.0
Habenaria orbiculata	1	10.0	.5	--	.1	.1	--	.1	.1	5.0

(continued on next page)

Table 15 continued

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Goodyera repens	1	10.0	0.5	--	0.1	0.1	--	0.1	0.1	5.0
Populus grandidentata (SA)	1	10.0	.5	0.6	.1	.3	0.1	.3	.2	5.0
Salix spp.	1	10.0	.5	5.0	.1	.5	.1	.4	.3	5.0
Galium boreale	1	10.0	.5	--	.1	.1	--	.1	.1	5.0
Pinus resinosa (T)	1	10.0	.5	.1	.1	.2	.1	.4	.2	5.0
Cladonia sylvatica	1	10.0	.5	--	.1	.2	--	.1	.1	5.0
Viburnum rafinesquianum	1	10.0	.5	30.0	.1	.2	.2	.2	.2	5.0
Sorbus americana (SA)	1	10.0	.5	.3	.1	.3	.1	.2	.2	5.0
Epigaea repens	1	10.0	.5	--	.2	.1	--	.5	.3	5.0
Sphagnum spp.	1	10.0	.5	--	.4	.2	--	.4	.3	5.0
Pinus resinosa (SE)	1	10.0	.5	5.0	.1	.2	.1	.1	.1	5.0
Pinus banksiana (SA)	1	10.0	.5	.3	.1	.3	.1	.1	.2	5.0
Gaultheria hispidula	1	10.0	.5	--	.1	1.4	--	1.5	1.5	5.0
Apocynum androsaemifolium	1	10.0	.0	--	.1	.0	--	.1	.1	.0
Actaea rubra	1	10.0	.0	--	.1	.0	--	.1	.1	.0
Epilobium angustifolium	1	10.0	.0	--	.1	.0	--	.1	.1	.0
Pteridium aquilinum	1	10.0	.0	--	.1	.0	--	.1	.1	.0
Ground cover characteristic:										
Litter	10	100.0	99.5	--	70.2	33.2	--	70.0	51.4	9,950.0
Dead wood	10	100.0	36.5	--	4.5	12.0	--	4.4	8.5	3,650.0
Bare rock	5	50.0	6.5	--	.5	2.1	--	.5	1.4	325.0
Live wood	4	40.0	4.0	--	.3	1.6	--	.2	.9	160.0
Bare ground	2	20.0	2.0	--	.1	.5	--	.1	.2	40.0

Table 16. – Stand data summary for the fir-birch community

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Abies balsamea (SA)	8	100.0	94.7	260.1	8.4	56.3	74.6	70.4	67.0	9,475.0
Other mosses	8	100.0	85.2	--	11.5	27.5	--	11.5	19.4	8,525.0
Abies balsamea (T)	8	100.0	77.2	153.5	26.0	35.9	43.8	27.1	35.6	7,725.0
Abies balsamea (SE)	8	100.0	75.0	9,877.1	6.1	46.7	58.2	67.6	57.5	7,500.0
Acer spicatum	8	100.0	70.4	6,689.6	4.2	52.5	70.5	80.9	68.0	7,037.5
Betula papyrifera (T)	8	100.0	61.0	106.6	27.0	29.1	26.4	31.4	29.0	6,100.0
Calliergonella schreberi	8	100.0	45.0	--	9.3	13.4	--	9.4	11.3	4,500.0
Betula papyrifera (SA)	8	100.0	43.5	76.6	3.1	24.5	16.1	19.5	20.0	4,350.0
Cornus canadensis	8	100.0	35.9	--	2.8	15.6	--	17.7	16.7	3,587.5
Betula papyrifera (SE)	8	100.0	28.1	1,854.1	.5	19.9	16.9	9.5	15.5	2,812.5
Corylus cornuta	7	87.5	29.6	1,395.9	.8	20.1	13.1	10.6	14.7	2,592.2
Sorbus americana (SE)	8	100.0	24.7	545.9	.5	19.1	15.1	11.7	15.2	2,475.0
Picea mariana (T)	7	87.5	27.5	31.4	9.3	12.2	8.6	9.3	10.2	2,406.3
Maianthemum canadense	7	87.5	25.0	--	.7	11.4	--	6.1	8.8	2,187.5
Aster macrophyllus	7	87.5	22.7	--	3.7	8.5	--	19.7	14.2	1,990.6
Linnaea borealis	7	87.5	21.0	--	1.0	8.0	--	5.8	7.0	1,837.5
Viola spp.	7	87.5	19.6	--	.5	7.5	--	2.8	5.4	1,717.2
Thuja occidentalis (T)	6	75.0	18.5	22.6	11.4	8.3	7.8	13.2	9.9	1,387.5
Dicranum spp.	5	62.5	21.3	--	1.5	6.0	--	1.4	3.8	1,328.1
Lonicera canadensis	6	75.0	15.9	743.8	.2	11.3	7.8	3.5	7.5	1,190.6
Aralia nudicaulis	6	75.0	14.6	--	1.2	5.0	--	5.4	5.3	1,096.9
Clintonia borealis	5	62.5	17.5	--	1.8	5.6	--	7.8	6.8	1,093.8
Galium triflorum	7	87.5	11.6	--	.2	4.4	--	1.0	2.9	1,017.2
Picea glauca (T)	7	87.5	9.8	7.9	4.5	4.8	2.9	5.1	4.1	853.1
Rubus strigosus	4	50.0	15.4	--	4.0	25.7	--	27.2	26.5	768.8
Diervilla Lonicera	7	87.5	8.8	337.5	.1	6.1	5.0	2.1	4.4	765.6
Populus tremuloides (T)	4	50.0	15.2	11.4	4.5	8.4	9.3	12.2	10.0	762.5
Picea mariana (SA)	6	75.0	9.4	8.9	.4	5.5	2.1	2.9	3.6	703.1
Other lichens	6	75.0	9.1	--	.3	2.6	--	.3	1.6	684.4
Trientalis borealis	6	75.0	8.8	--	.3	4.6	--	3.6	4.1	656.3
Thuja occidentalis (SA)	4	50.0	12.1	14.6	.6	6.6	3.1	4.5	4.8	606.3
Rubus pubescens	5	62.5	8.8	--	.5	27.4	--	26.0	26.7	546.9
Lycopodium obscurum	4	50.0	10.0	--	.9	3.3	--	3.9	3.6	500.0
Streptopus roseus	6	75.0	6.3	--	.3	2.1	--	1.3	1.6	468.8
Gramineae	5	62.5	7.5	--	.2	2.5	--	.9	1.8	468.8
Lycopodium annotinum	4	50.0	9.1	--	1.1	5.8	--	11.1	8.4	456.3
Populus tremuloides (SE)	4	50.0	8.8	202.1	.2	4.3	2.0	1.8	2.8	437.5
Thuja occidentalis (SE)	4	50.0	8.5	1,479.1	.4	4.6	4.8	6.5	5.4	425.0
Lycopodium clavatum	5	62.5	5.4	--	.8	1.8	--	3.5	2.6	335.9
Hypnum crista-castrensis	5	62.5	5.0	--	.4	1.5	--	.3	1.0	312.5
Coptis groenlandica	4	50.0	6.3	--	.2	1.9	--	.8	1.4	312.5
Populus tremuloides (SA)	3	37.5	7.1	3.8	.1	4.0	1.9	1.9	2.6	267.2
Vaccinium myrtilloides	4	50.0	5.0	--	.4	12.2	--	9.1	10.6	250.0
Pyrola secunda	3	37.5	6.3	--	.2	2.3	--	.8	1.6	234.4
Picea glauca (SA)	4	50.0	4.4	2.9	.1	2.6	1.0	.9	1.6	218.8
Amelanchier spp.	4	50.0	4.4	87.5	.1	2.8	1.0	.6	1.5	218.8
Fragaria vesca	3	37.5	5.4	--	.4	1.6	--	1.6	1.6	201.6
Hylocomium splendens	3	37.5	4.4	--	.9	1.3	--	1.0	1.0	164.1
Picea mariana (SE)	3	37.5	3.1	162.5	.1	1.6	2.0	1.5	1.8	117.2
Pyrola virens	3	37.5	2.9	--	.1	1.0	--	.3	.6	107.8
Polytrichum spp.	3	37.5	2.5	--	.2	.8	--	.3	.5	93.8
Cyperaceae	3	37.5	2.3	--	.1	.8	--	.5	.6	84.4
Picea glauca (SE)	2	25.0	2.8	27.1	.1	1.4	.3	.4	.8	68.8
Lonicera hirsuta	1	12.5	5.3	83.4	.1	2.8	.5	.3	1.1	65.6
Gymnocarpium dryopteris	2	25.0	1.9	--	.1	1.0	--	.4	.6	46.9
Sorbus americana (SA)	2	25.0	1.9	3.5	.1	1.0	.4	.3	.6	46.9
Goodyera repens	2	25.0	1.9	--	.1	.6	--	.1	.4	46.9
Cladonia sylvatica	2	25.0	1.9	--	.2	.6	--	.1	.5	46.9
Cornus rugosa	2	25.0	1.6	58.4	.1	.9	.5	.1	.5	40.6
Mitella nuda	2	25.0	1.3	--	.1	1.1	--	1.1	1.3	31.3
Alnus crispa	2	25.0	1.3	25.0	.1	1.0	.4	.3	.5	31.3
Prunus pensylvanica	2	25.0	1.3	12.5	.1	.9	.1	.1	.3	31.3
Impatiens capensis	1	12.5	2.5	--	.3	.8	--	1.0	.9	31.3
Acer rubrum (SE)	1	12.5	2.5	62.5	.1	1.1	.4	.8	.8	31.3
Circaea alpina	1	12.5	1.9	--	.1	.6	--	.1	.4	23.4
Pinus strobus (T)	1	12.5	1.9	2.5	.6	.8	.5	.8	.6	23.4
Chimaphila umbellata	1	12.5	1.3	--	.1	3.1	--	1.0	2.1	15.6
Vaccinium angustifolium	1	12.5	1.3	--	.1	3.1	--	2.4	2.8	15.6
Petasites vitifolius	2	25.0	.6	--	.1	.3	--	.4	.3	15.6
Rubus parviflorus	2	25.0	.6	--	.6	1.8	--	8.0	4.9	15.6
Taxus canadensis	1	12.5	1.3	31.3	.1	1.6	1.1	.4	1.0	15.6
Moneses uniflora	1	12.5	1.3	--	.1	.4	--	.3	.3	15.6
Lathyrus ochroleucus	1	12.5	1.0	--	.1	.4	--	.3	.4	12.5
Apocynum androsaemifolium	1	12.5	.6	--	.1	.3	--	.1	.2	7.8
Pinus strobus (SE)	1	12.5	.6	6.3	.1	.3	.1	.1	.1	7.8
Fraxinus nigra (SE)	1	12.5	.6	6.3	.1	.4	.1	.3	.3	7.8
Cynoglossum boreale	1	12.5	.6	--	.1	.3	--	.3	.3	7.8
Goodyera tesselata	1	12.5	.6	--	.1	.5	--	.1	.3	7.8
Athyrium filix-femina	1	12.5	.6	--	.1	.3	--	.1	.1	7.8
Pinus banksiana (T)	1	12.5	.6	.4	.4	.3	.1	.6	.4	7.8
Sorbus americana (T)	1	12.5	.6	.3	.1	.3	.1	.1	.2	7.8
Pteridium aquilinum	1	12.5	.6	--	.1	.1	--	.4	.3	7.8
Ribes spp.	1	12.5	.6	--	.1	1.6	--	1.3	1.4	7.8
Cladonia rangiferina	1	12.5	.6	--	.1	.1	--	.1	.1	7.8
Sambucus spp.	1	12.5	.6	18.7	.1	.5	.1	.9	.5	7.8
Dryopteris spinulosa	1	12.5	.6	--	.1	.1	--	.3	.3	7.8
Ground cover characteristic:										
Litter	8	100.0	98.1	--	70.6	31.6	--	70.7	51.3	9,812.5
Dead wood	8	100.0	36.3	--	4.4	11.6	--	4.4	7.8	3,625.0
Live wood	5	62.5	6.3	--	.5	2.0	--	.5	1.3	390.6
Bare rock	3	37.5	1.9	--	.1	.4	--	.1	.3	70.3
Bare ground	1	12.5	1.3	--	.1	.5	--	.1	.3	15.6

Table 17. – Stand data summary for the white-cedar community

Item	Number of stands	Percent presence	Average frequency	Average density	Basal area or cover	Relative frequency	Relative density	Relative dominance	Importance value	Commonness Index
Species:										
Thuja occidentalis (T)	9	100.0	91.7	214.1	82.7	40.8	50.7	48.7	46.7	9,166.7
Other mosses	9	100.0	80.6	--	10.3	29.4	--	10.2	19.9	8,055.6
Abies balsamea (SE)	9	100.0	76.1	14,594.4	1.7	38.2	60.4	37.7	45.4	7,611.1
Acer spicatum	9	100.0	68.9	5,661.1	4.3	48.8	49.4	59.9	52.9	6,888.9
Betula papyrifera (T)	9	100.0	48.3	74.7	28.3	21.1	16.7	17.4	18.4	4,833.3
Thuja occidentalis (SA)	7	77.8	59.4	169.2	6.2	34.2	37.1	39.3	36.9	4,623.5
Abies balsamea (T)	8	88.9	47.8	76.6	16.7	19.4	18.0	10.4	16.1	4,246.9
Abies balsamea (SA)	7	77.8	49.4	177.0	4.8	27.7	30.3	27.6	28.4	3,845.7
Thuja occidentalis (SE)	9	100.0	33.9	2,161.1	1.2	16.8	14.2	27.7	19.6	3,388.9
Maianthemum canadense	9	100.0	31.7	--	1.1	12.3	--	7.4	10.0	3,166.7
Sorbus americana (SE)	8	88.9	35.0	816.7	.7	19.0	9.1	18.6	15.6	3,111.1
Cornus canadensis	9	100.0	23.9	--	1.1	10.0	--	7.4	8.8	2,388.9
Trientalis borealis	9	100.0	22.8	--	.9	8.7	--	4.9	6.7	2,277.8
Aster macrophyllus	7	77.8	23.3	--	2.1	10.9	--	21.4	16.1	1,814.8
Viola spp.	8	88.9	20.0	--	.7	7.3	--	3.7	5.3	1,777.8
Clintonia borealis	8	88.9	20.0	--	1.6	8.1	--	12.1	10.2	1,777.8
Betula papyrifera (SA)	7	77.8	22.8	42.8	1.9	11.9	8.3	9.2	10.0	1,771.6
Betula papyrifera (SE)	7	77.8	22.2	966.7	.2	11.7	10.8	6.1	9.6	1,728.4
Lonicera canadensis	9	100.0	15.6	661.1	.1	13.9	13.1	11.1	12.7	1,555.6
Aralia nudicaulis	8	88.9	17.2	--	2.3	5.6	--	10.7	8.0	1,530.9
Taxus canadensis	5	55.6	27.2	4,316.7	1.0	14.1	19.8	11.3	15.1	1,512.3
Mitella nuda	6	66.7	21.7	--	1.1	7.8	--	6.8	7.3	1,444.4
Corylus cornuta	8	88.9	16.1	950.0	.6	12.0	10.9	11.6	11.6	1,432.1
Picea glauca (T)	8	88.9	14.4	16.2	11.4	6.2	4.0	7.2	5.8	1,284.0
Streptopus roseus	7	77.8	13.3	--	.9	4.8	--	3.9	4.3	1,037.0
Calliergonella schreberi	6	66.7	14.4	--	1.6	4.4	--	1.7	3.1	963.0
Picea glauca (SE)	7	77.8	11.1	161.1	.1	5.1	1.6	3.4	3.3	864.2
Pinus strobus (SE)	4	44.4	18.3	777.8	.2	6.0	1.7	3.9	3.8	814.8
Populus tremuloides (T)	4	44.4	16.7	38.8	19.4	6.9	5.7	10.8	7.7	740.7
Rubus pubescens	6	66.7	8.9	--	.6	54.7	--	54.4	54.6	592.6
Diervilla Lonicera	5	55.6	9.4	316.7	.1	6.3	4.2	3.4	4.8	524.7
Hylocomium splendens	4	44.4	10.0	--	.6	3.0	--	.6	1.8	444.4
Pinus strobus (T)	4	44.4	7.8	15.2	7.0	3.0	2.2	4.3	3.3	345.7
Gymnocarpium Dryopteris	4	44.4	6.1	--	.6	2.0	--	2.9	2.4	271.6
Rubus parviflorus	3	33.3	6.7	--	1.5	17.6	--	32.1	24.9	222.2
Populus tremuloides (SE)	3	33.3	6.1	138.9	.1	2.8	2.2	1.9	2.3	203.7
Hypnum crista-castrensis	4	44.4	3.9	--	.1	1.2	--	.1	.6	172.8
Pyrola secunda	4	44.4	3.9	--	.1	2.3	--	1.0	1.7	172.8
Dicranum spp.	3	33.3	5.0	--	.3	1.4	--	.2	.8	166.7
Galium triflorum	3	33.3	4.4	--	.1	1.0	--	.2	.7	148.1
Gramineae	3	33.3	4.4	--	.1	2.2	--	.9	1.7	148.1
Dryopteris spinulosa	3	33.3	4.4	--	1.3	1.3	--	4.2	2.8	148.1
Lycopodium obscurum	3	33.3	4.4	--	.3	2.4	--	2.7	2.6	148.1
Other lichens	3	33.3	3.9	--	.1	1.3	--	.2	.7	129.6
Cyperaceae	2	22.2	5.0	--	.2	1.1	--	.3	.8	111.1
Impatiens capensis	2	22.2	5.0	--	.5	1.2	--	1.3	1.3	111.1
Amelanchier spp.	3	33.3	3.3	44.4	.1	2.4	.9	.8	1.3	111.1
Linnaea borealis	3	33.3	3.3	--	.1	2.4	--	.8	1.6	111.1
Lycopodium annotinum	3	33.3	2.8	--	.1	1.0	--	.7	.9	92.6
Picea mariana (T)	3	33.3	2.8	3.7	1.0	1.1	.6	.7	.8	92.6
Lycopodium lucidulum	3	33.3	2.8	--	.2	1.9	--	2.6	2.1	92.6
Sorbus americana (T)	2	22.2	3.9	1.9	.2	1.6	1.1	.1	.9	86.4
Pyrola virens	3	33.3	2.2	--	.1	.8	--	.8	.7	74.1
Picea glauca (SA)	3	33.3	2.2	1.4	.1	1.4	.4	.9	1.0	74.1
Sorbus americana (SA)	3	33.3	1.7	1.4	.1	1.1	.3	.3	.7	55.6
Goodyera repens	2	22.2	1.7	--	.1	.6	--	.2	.3	37.0
Coptis groenlandica	2	22.2	1.7	--	.1	.6	--	.1	.3	37.0
Polytrichum spp.	2	22.2	1.7	--	.1	.6	--	.1	.3	37.0
Moneses uniflora	2	22.2	1.1	--	.1	.9	--	.3	.6	24.7
Chimaphila umbellata	2	22.2	1.1	--	.1	2.7	--	.2	1.6	24.7
Picea mariana (SA)	2	22.2	1.1	2.3	.1	.6	.2	.1	.4	24.7
Mertensia paniculata	1	11.1	1.7	--	.1	.3	--	.2	.2	18.5
Alnus crispa	1	11.1	1.7	55.6	.1	.9	.7	1.0	.9	18.5
Botrychium virginianum	1	11.1	1.7	--	.1	.4	--	.2	.3	18.5
Oxalis montana	1	11.1	1.1	--	.1	.4	--	.4	.4	12.3
Cornus rugosa	1	11.1	1.1	11.1	.1	.8	.1	.1	.3	12.3
Circaea alpina	1	11.1	1.1	--	.1	.4	--	.4	.4	12.3
Acer rubrum (SE)	1	11.1	.6	5.6	.1	.2	.1	.1	.1	6.2
Cystopteris fragilis	1	11.1	.6	--	.1	.3	--	.1	.2	6.2
Anemone quinquefolia	1	11.1	.6	--	.1	.2	--	.3	.3	6.2
Habenaria orbiculata	1	11.1	.6	--	.1	.1	--	.4	.3	6.2
Lycopodium complanatum	1	11.1	.6	--	.1	.2	--	.1	.1	6.2
Ribes americana	1	11.1	.6	27.8	.1	.3	.2	.1	.2	6.2
Salix bebbiana	1	11.1	.6	5.6	.1	.3	.1	.1	.1	6.2
Pinus strobus (SA)	1	11.1	.6	1.3	.1	.3	.1	.1	.2	6.2
Populus tremuloides (SA)	1	11.1	.6	.3	.1	.2	.1	.1	.1	6.2
Ribes triste	1	11.1	.6	11.1	.1	.3	.1	.1	.1	6.2
Athyrium filix-femina	1	11.1	.6	--	.1	.1	--	.2	.1	6.2
Rubus strigosus	1	11.1	.6	--	.1	1.1	--	1.9	1.6	6.2
Pinus resinosa (T)	1	11.1	.6	1.0	.6	.2	.1	.4	.2	6.2
Clematis virginiana	1	11.1	.6	--	.1	.1	--	.1	.1	6.2
Vaccinium angustifolium	1	11.1	.6	--	.1	1.6	--	.2	.9	6.2
Picea mariana (SE)	1	11.1	.6	5.6	.1	.4	.1	.2	.2	6.2
Pinus banksiana (SA)	1	11.1	.6	1.2	.1	.2	.1	.1	.1	6.2
Pteridium aquilinum	1	11.1	.0	--	.1	.0	--	.6	.6	.0
Ground cover characteristic:										
Litter	9	100.0	100.0	--	82.5	39.0	--	82.3	60.6	10,000.0
Dead wood	9	100.0	45.0	--	3.9	16.2	--	3.9	10.0	4,500.0
Live wood	6	66.7	4.4	--	.2	1.7	--	.1	1.0	296.3
Bare rock	4	44.4	2.8	--	.2	1.0	--	.2	.6	123.5
Bare ground	1	11.1	1.1	--	.1	.3	--	.1	.2	12.3

Table 18. – Families represented by more than one species in the sample. The last two columns represent the average within family percent presence of occurrence in stands and average within family percent frequency occurrence in sample points or plots

Family	Number of species	Percent presence	Percent frequency
Ericaceae	15	13.3	2.4
Rosaceae	12	18.9	3.1
Pinaceae	8	34.9	12.7
Polypodiaceae	8	8.2	1.0
Compositae	7	11.4	5.0
Caprifoliaceae	7	31.2	8.7
Liliaceae	5	41.1	14.7
Lycopodiaceae	5	24.9	3.5
Betulaceae	4	58.5	20.2
Salicaceae	4	24.2	6.4
Cladoniaceae	4	15.3	3.6
Ranunculaceae	4	12.2	1.5
Cornaceae	3	37.7	11.3
Hypnaceae	3	43.7	14.3
Orchidaceae	3	6.6	.4
Saxifragaceae	3	5.1	.8
Aceraceae	2	43.8	19.2
Araliaceae	2	39.6	9.4
Rubiaceae	2	15.6	1.6
Fabaceae	2	8.5	.5
Onagraceae	2	3.3	.2
Boraginaceae	2	.9	.1

Community Comparisons

Figures 11 through 17 depict the importance of the most prevalent species in the tree, sapling, seedling, tall shrub, low shrub, herb, and moss-lichen classes *among* the 12 community types by size of circle. From small to large, they indicate the following four ranges of percent of maximum density or ground cover: 0-25, 26-50, 51-75, 76-100. Similarly, importance *within* each community is indicated by shading, as follows: ¼ shaded = 0-25, ½ shaded = 26-50, ¾ shaded = 51-75, fully shaded = 76-100. Thus, by comparing circle size across the page one can determine the relative importance of the species among the communities, and by comparing amount of shading down the page one can determine the relative importance of species within each community.

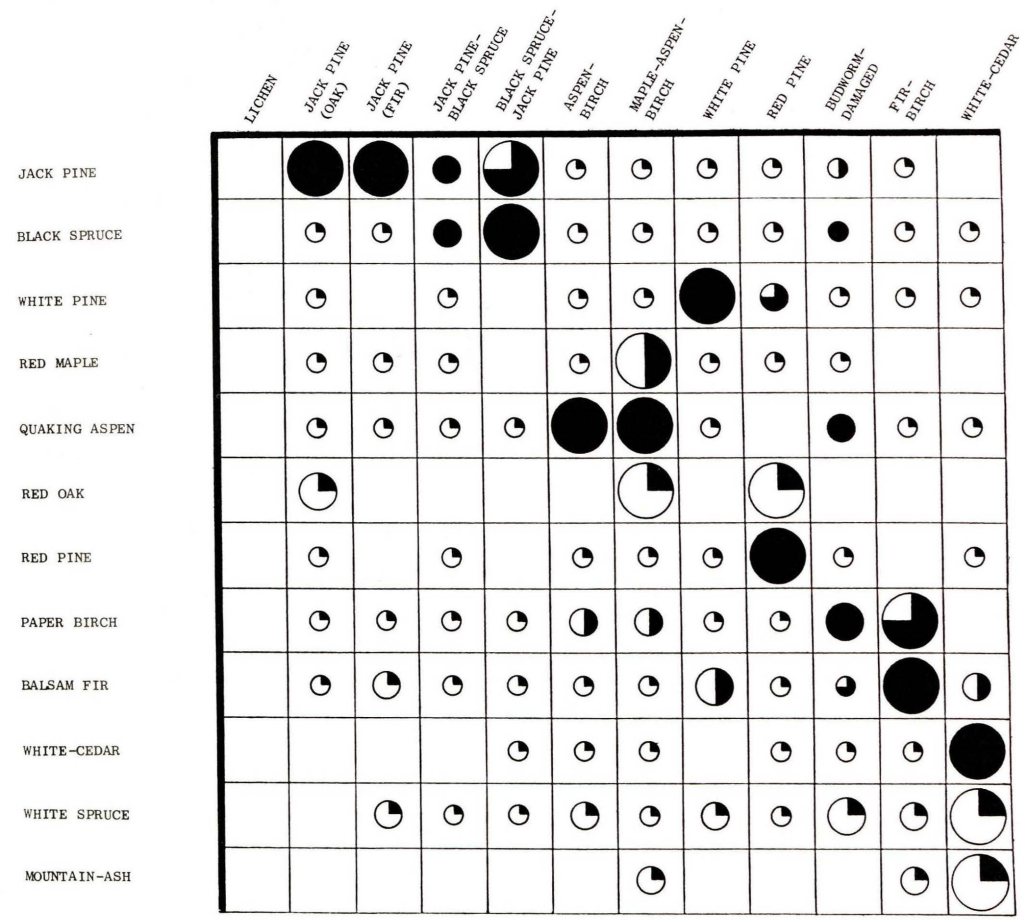


Figure 11. – Importance of tree species density (tree size class) among and within communities.

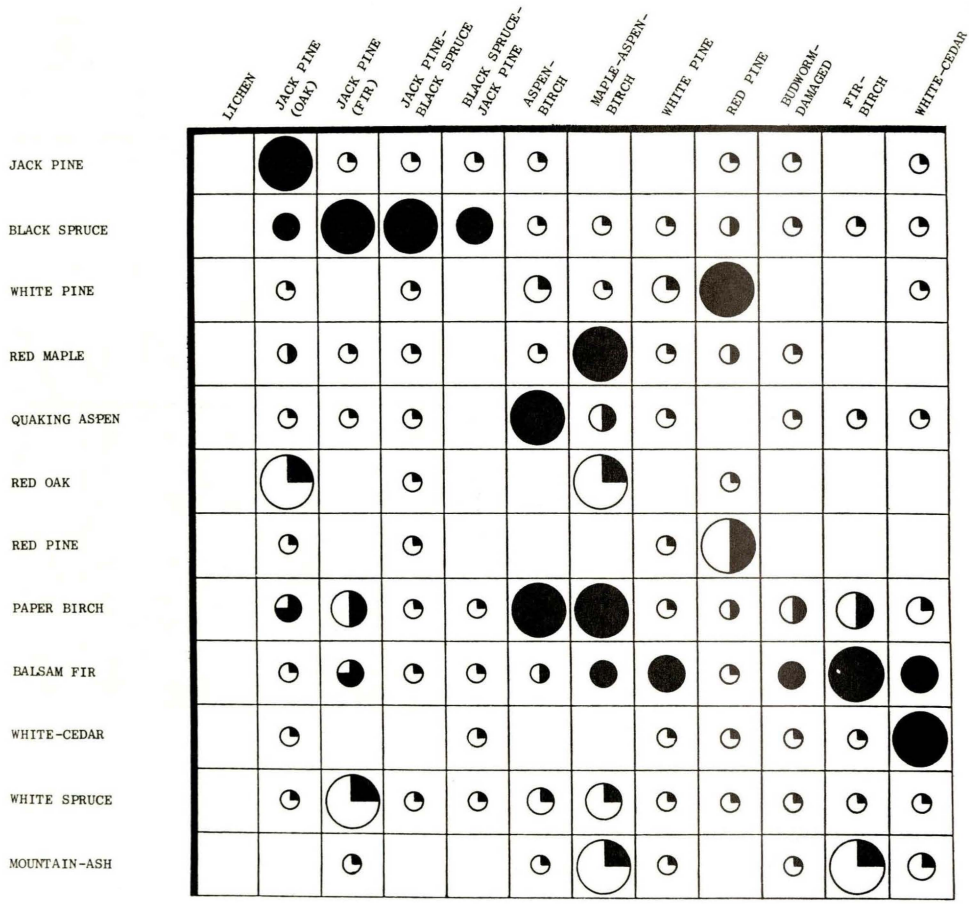


Figure 12. – Importance of tree species density (sapling size class) among and within communities.

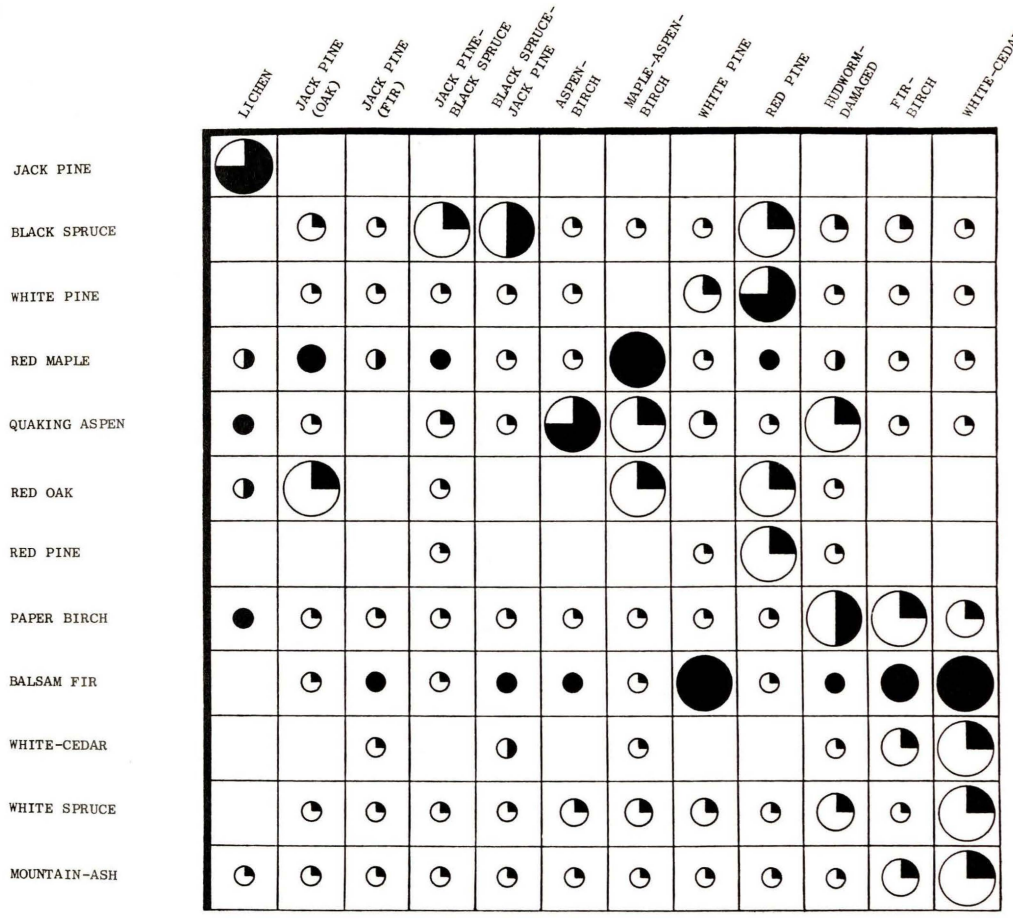


Figure 13. – Importance of tree species density (seedling size class) among and within communities.

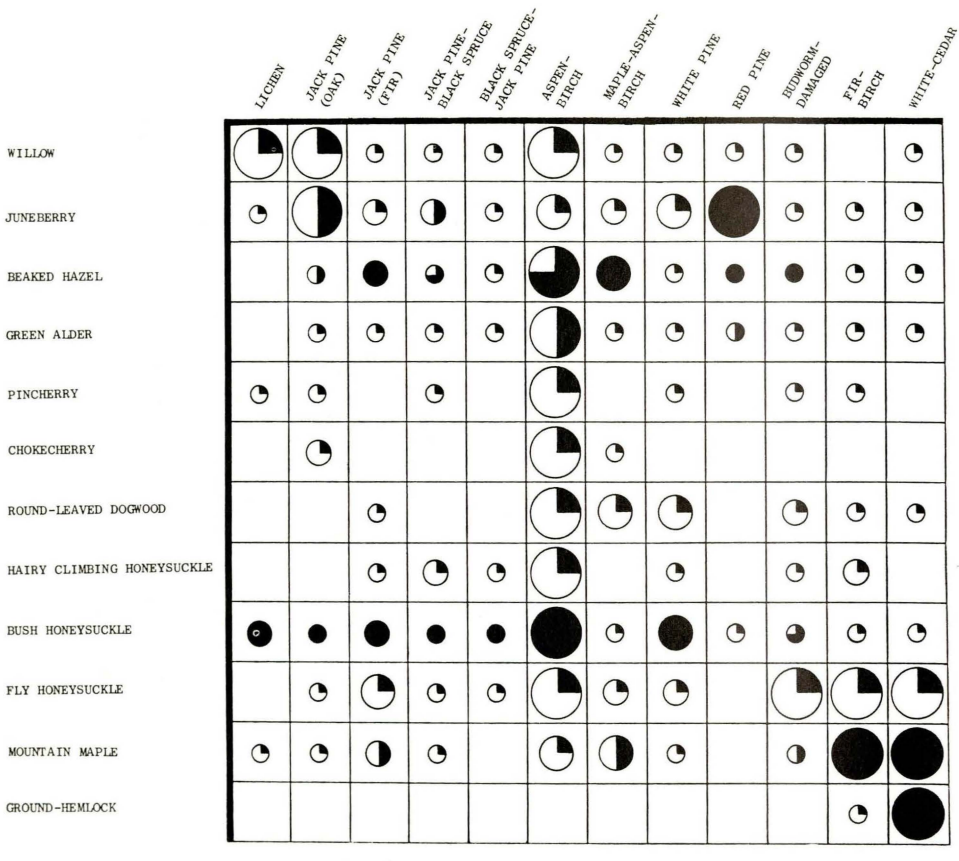


Figure 14. – Importance of tall shrub species density among and within communities.

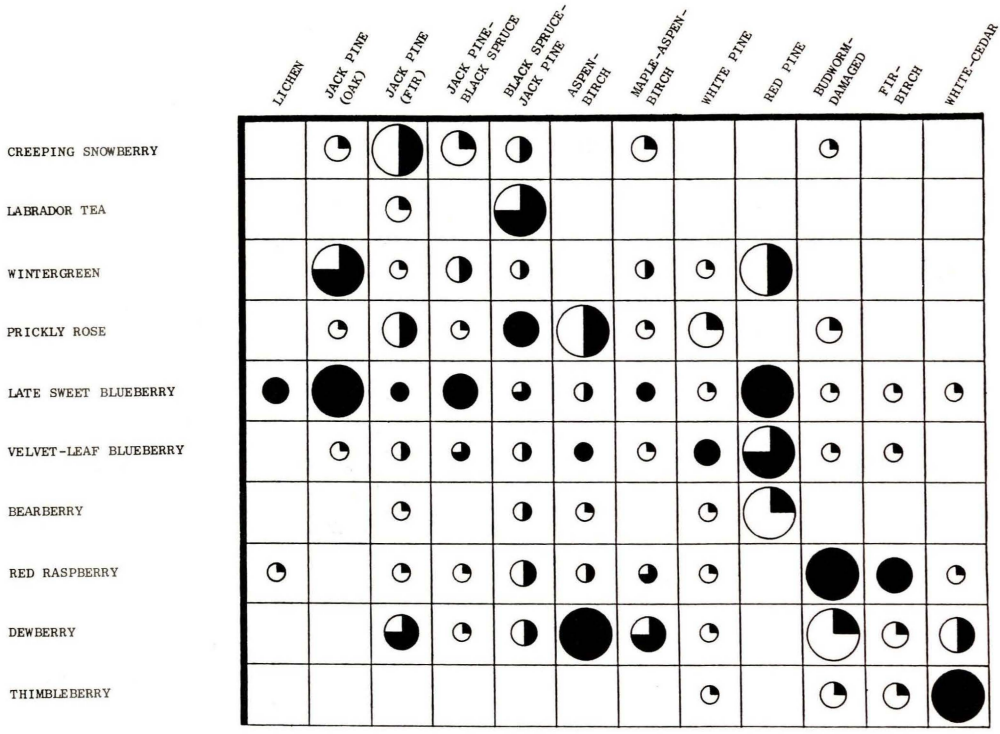


Figure 15. – Importance of low shrub species percent cover among and within communities.

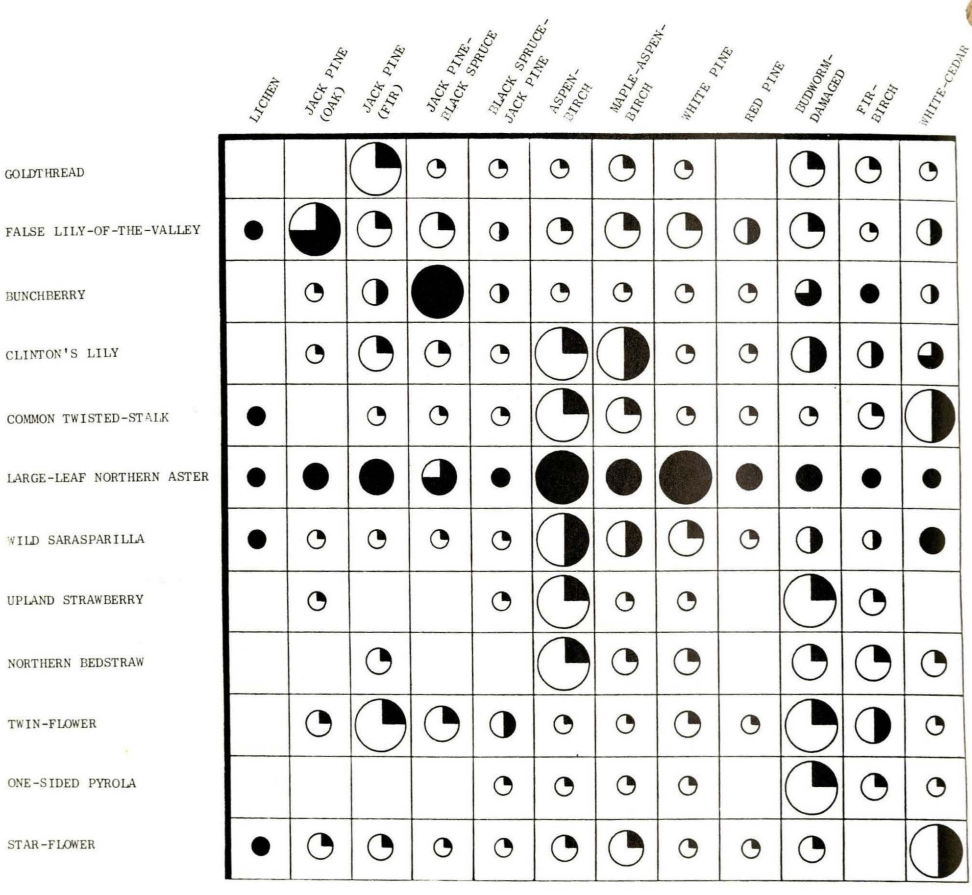


Figure 16. – Importance of herb species percent cover among and within communities.

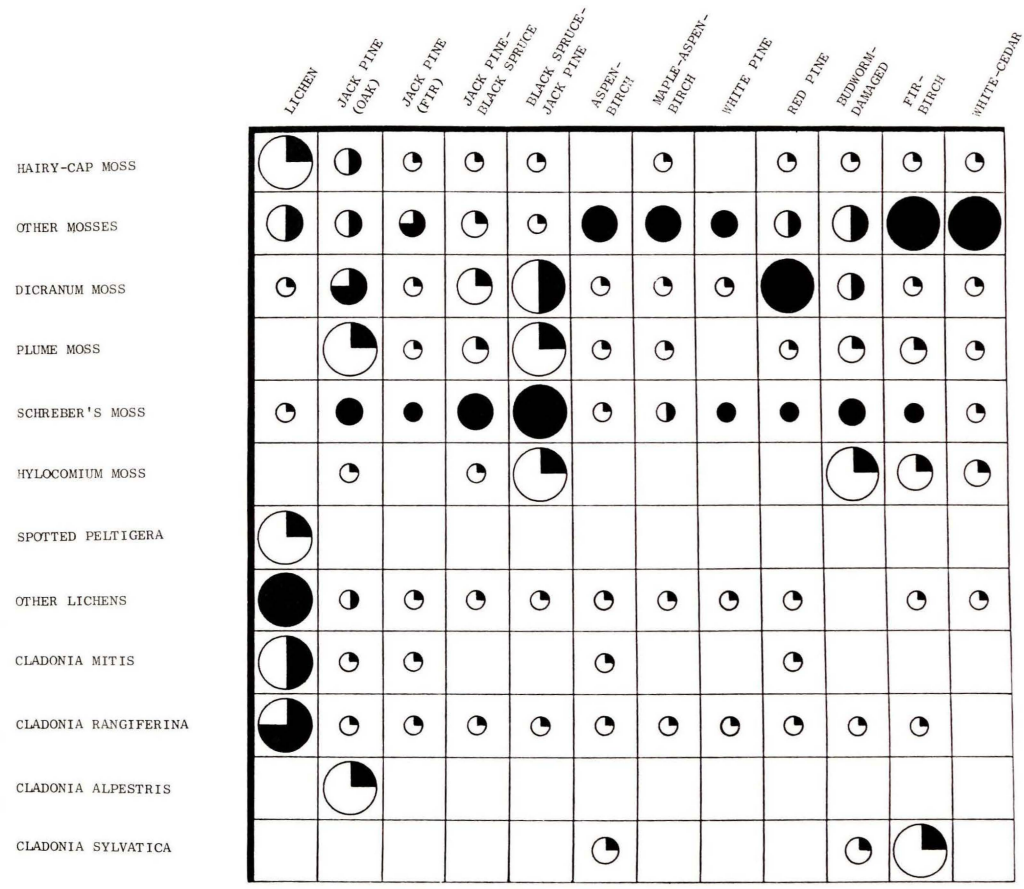


Figure 17. – Importance of moss and lichen species percent cover among and within communities.

SOME RECENT RESEARCH PAPERS OF THE NORTH CENTRAL FOREST EXPERIMENT STATION

Proceedings of the Ninth Lake States Forest Tree Improvement Conference, August 22-23, 1969. USDA Forest Serv. Res. Pap. NC-47, 34 p. 1970.

A Water Curtain for Controlling Experimental Forest Fires, by Von J. Johnson. USDA Forest Serv. Res. Pap. NC-48, 7 p., illus. 1970.

Wilderness Ecology: A Method of Sampling and Summarizing Data for Plant Community Classification, by Lewis F. Ohmann and Robert R. Ream. USDA Forest Serv. Res. Pap. NC-49, 14 p., illus. 1971.

Predicting Lumber Grade Yields for Standing Hardwood Trees, by Charles L. Stayton, Richard M. Marden, and Glenn L. Gammon. USDA Forest Serv. Res. Pap. NC-50, 8 p. 1971.

Tables of Compound-Discount Interest Rate Multipliers for Evaluating Forestry Investments, by Allen L. Lundgren. USDA Forest Serv. Res. Pap. NC-51, 142 p., illus. 1971.

Ecological Studies of the Timber Wolf in Northeastern Minnesota, by L. David Mech and L. D. Frenzel, Jr. (Editors). USDA Forest Serv. Res. Pap. NC-52, 62 p., illus. 1971.

Pest Susceptibility Variation in Lake States Jack-Pine Seed Sources, by James P. King. USDA Forest Serv. Res. Pap. NC-53, 10 p., illus. 1971.

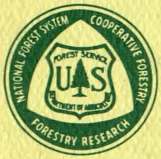
Influence of Stand Density on Stem Quality in Pole-size Northern Hardwoods, by Richard M. Godman and David J. Books. USDA Forest Serv. Res. Pap. NC-54, 7 p., illus. 1971.

The Dynamic Forces and Moments Required in Handling Tree-length Logs, by John A. Sturos. USDA Forest Serv. Res. Pap. NC-55, 8 p., illus. 1971.

Growth and Yield of Black Spruce on Organic Soils in Minnesota, by Donald A. Perala. USDA Forest Serv. Res. Pap. NC-56, 16 p., illus. 1971.

ABOUT THE FOREST SERVICE . . .

As our Nation grows, people expect and need more from their forests — more wood; more water, fish, and wildlife; more recreation and natural beauty; more special forest products and forage. The Forest Service of the U.S. Department of Agriculture helps to fulfill these expectations and needs through three major activities:



- Conducting forest and range research at over 75 locations ranging from Puerto Rico to Alaska to Hawaii.
- Participating with all State forestry agencies in cooperative programs to protect, improve, and wisely use our Country's 395 million acres of State, local, and private forest lands.
- Managing and protecting the 187-million acre National Forest System.

The Forest Service does this by encouraging use of the new knowledge that research scientists develop; by setting an example in managing, under sustained yield, the National Forests and Grasslands for multiple use purposes; and by cooperating with all States and with private citizens in their efforts to achieve better management, protection, and use of forest resources.

Traditionally, Forest Service people have been active members of the communities and towns in which they live and work. They strive to secure for all, continuous benefits from the Country's forest resources.

For more than 60 years, the Forest Service has been serving the Nation as a leading natural resource conservation agency.